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REVIEW
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AGARWALA (S. C.) & HEWITT (E. J.). **The effects of some different nitrogen sources on the molybdenum requirements of Cauliflower plants grown in sand culture.**—*Rep. agric. hort. Res. Sta. Bristol, 1952*, pp. 195–199, 1 pl., 1952.

The results of the experiments carried out at Long Ashton Research Station to determine the effect of various sources of nitrogen on the molybdenum requirements of cauliflower [*R.A.M.*, 33, p. 128] confirmed and supplemented those obtained previously [31, p. 466; 32, p. 600]. Deficiency in the presence of nitrate was more striking when malate or sucrose was added. Wilting and withering of the foliage were observed only in the presence of nitrate, including ammonium nitrate. Mottling, too, was characteristic of nitrate and, to a lesser extent, of nitrite. Whiptail symptoms were secured with nitrite [loc. cit.] and with glutamic acid. They were accentuated by citrate or malate supplements, which greatly increased mottling, wilting, and withering. The chlorophyll content was greatly decreased by molybdenum deficiency only in the presence of nitrate and even more so when citrate or malate was added to it. A concentration of 0·05 to 0·1 p.p.m. molybdenum was detected in plants receiving none, while those given an adequate supply contained 1·8 to 8·5 p.p.m. These concentrations were slightly higher in the presence of nitrite, urea, and glutamic acid than with ammonium or nitrate supplements.

STEUDEL (W.). **Epidemiologische Studien zur Vergilbungskrankheit im Rheinland 1952.** [Epidemiological studies on yellows disease in Rhineland 1952.]—*Zucker*, 6, 4, pp. 69–73, 6 graphs, 1953.

The abnormally dry and warm April of 1952 in Rhineland, Germany, was followed by similar weather in May, while the June rainfall, though about normal in amount, was unevenly distributed. These conditions favoured the development of the aphid vectors of beet yellows virus [see following abstracts], *Myzodes* [*Myzus*] *persicae* and *Doralis* [*Aphis*] *fabae*, and paved the way for the ensuing severe epiphytotic of the disease [*R.A.M.*, 32, p. 529]. In the most heavily infested areas there was a consistent positive relationship between mass colonization by the summer migrants and late sowing and wide spacing of the crop [cf. 33, p. 131].

LÜDECKE (W.). **Was kann gegen die Vergilbungskrankheit der Rübe unternommen werden?** [What can be done against Beet yellows disease?]—*Zucker*, 6, 5, pp. 91–92, 1953.

In the Weser Valley, Germany, early infection of sugar beet crops by the yellows virus [see preceding and next abstracts] may result in reductions of 60 and 70 per cent. in the root yield and sugar content, respectively. The principal prophylactic measures are (1) the stimulation of rapid and luxuriant growth in young plants by autumn cultivation and adequate fertilization, early sowing with sufficient seed to produce 100,000 plants per ha. at singling time with a spacing of 42 by 25 cm. in the 'danger zones', and frequent hoeing; (2) elimination of all potential

sources of infection and exclusion of the winter hosts of the virus by restricting the cultivation of fodder and red beets, mangolds, and spinach, and growing no seed crops of these in sugar beet growing areas; isolation of sites for stecklings, seed, and one-year beets, preferably in the midst of cereal fields or at high altitudes where aphids are scarce, and separation of factory beets from the vicinity of fodder beet and steckling clamps and allotments; and (3) chemical control [*R.A.M.*, 33, p. 131], which is always profitable in steckling and seed beet stands but need be applied to factory beets only at the time of mass movements of the aphid vectors in critical areas.

Schulze (E.). **Die Bedeutung der Vergilbekrankheit für Ertrag und Zuckergehalt der Zuckerrüben. (Vorläufige Mitteilung.)** [The importance of yellows disease for yield and sugar content of Sugar Beets. (Preliminary Note.)]—Reprinted from *Mitt. dtsch. LandwGes.*, *1953*, 4, 4 pp., 2 figs., 5 graphs, 1953.

The results of regular comparative observations during the growing period (from about mid-July to end of October) of samples of healthy (or symptomless) sugar beets and those with yellows virus on an experimental farm near Bonn, Germany [cf. preceding and next abstracts], demonstrated reductions in the sugar content, sugar yield, and root yield of 1, 19, and 13 per cent., respectively [cf. *R.A.M.*, 33, p. 130]. There was, however, no corresponding diminution of foliage, presumably owing to the constant production of new shoots. Healthy beets contain less 'injurious' nitrogen than infected plants except at the height of development of new leaves by the latter, when the position is reversed. As development proceeds, the yield and sugar content of infected beets increase steadily, and it would appear from these preliminary investigations that heavier losses are incurred through faulty cultural practices than in consequence of the yellows virus itself.

Heiling (A.) & Steudel (W.). **Die Vergilbungskrankheit der Rübe. 2. Auflage.** [Yellows disease of Beet. 2nd Edition.]—*Flugbl. biol. BdAnst. Braunschw.* F3, 8 pp., 1 col. pl., 1 fig., 1953.

The second edition of this pamphlet [cf. *R.A.M.*, 29, p. 549] presents essential information, already noticed from other sources, on beet yellows virus and its control in Germany [cf. preceding abstracts].

Rietberg (H.). **Virus yellows in Western Europe.**—*Proc. Amer. Soc. Sug. Beet Tech.*, *1952*, pp. 536–539, [? 1952. Received 1953.]

The author recapitulates information on yellows virus of sugar beet in Western Europe [*R.A.M.*, 33, p. 132 and preceding abstracts]. Recent work at Bergen-op-Zoom, Holland, has shown that there are lines of sugar beet with more resistance to this disease than other lines.

Coons (G. H.). **Sugar Beet virus yellows situation in the United States.**—*Proc. Amer. Soc. Sug. Beet Tech.*, *1952*, pp. 540–548, [? 1952. Received 1953.]

The information in this paper has already been noticed from other sources [*R.A.M.*, 32, p. 228; 33, p. 6].

Coons (G. H.). **Disease resistance breeding of Sugar Beets—1918–1952.**—*Phytopathology*, 43, 6, pp. 297–303, 1 graph, 1953.

In this paper, presented at the Symposium on Disease Resistance at the 44th Annual Meeting of the American Phytopathological Society at Ithaca, New York, on 8th September, 1952, the author reviews 29 contributions (all but one American) to the literature from 1918 to 1952 on the breeding of sugar beets for resistance to diseases, notably beet curly top virus, leaf spot (*Cercospora beticola*), and black

root (*Aphanomyces cochlioides*) [see following abstracts]. The immense losses which at one time threatened the very existence of the beet sugar industry in the affected areas of the United States have been substantially reduced by the development of resistant varieties, and research is now concentrated on the combination of factors conferring resistance to the above-mentioned diseases and to downy mildew (*Peronospora schachtii*) [see below, p. 196] and rust (*Uromyces betae*), both of which have been combined with resistance to curly top, with improved physiological and morphological characters.

Downie (A. R.), Doxtator (C. W.), Swink (J. F.), Ogden (D.), Bowman (R. L.), & Tanner (J. C.). **Reaction of Sugar Beet strains to Aphanomyces cochlioides at three different locations.**—*Proc. Amer. Soc. Sug. Beet Tech., 1952*, pp. 393–395, [?1952. Received 1953.]

Sixteen strains of sugar beet were grown in soils naturally infested with *Aphanomyces cochlioides* [see below, p. 197, and preceding and next abstracts] at Waseca and Moorhead, Minnesota, and Mason City, Iowa, in 1951. The results demonstrated that definite progress is being made in securing resistance, which is independent of the locality where the beet is grown. Line 9–406–0 (élite of 1952 RR) gave the highest yields of roots and sugar in all three tests and 9–604–0 [see below, p. 197] came next in two.

Coons (G. H.), Stewart (D.), Bockstahler (H. W.), Deming (G. W.), Gaskill (J. O.), Lill (J. G.), & Schneider (C. L.). **Report of the 1951 evaluation tests of leaf spot and black root-resistant Sugar Beet varieties of the United States Department of Agriculture.**—*Proc. Amer. Soc. Sug. Beet. Tech., 1952*, pp. 445–451, [? 1952. Received 1953.]

Further agronomic evaluation tests of sugar beet varieties for resistance to leaf spot [*Cercospora beticola*: see following abstracts] and black root [*Aphanomyces cochlioides*: see preceding abstracts] were carried out in 17 different localities in the United States during 1951. The performance of three varieties, FC Accessions 1170, 1173, and 1177, was very promising; they combined a considerable degree of black root resistance with leaf spot resistance. Test results showed that the selections for black root resistance had high quality, and were superior in yield per acre when compared with non-resistant beets under conditions of *Aphanomyces* infection.

Peterson (D. F.) & Cormany (C. E.). **A new leaf-spot-resistant variety.**—*Proc. Amer. Soc. Sug. Beet Tech., 1952*, pp. 382–383, [? 1952. Received 1953.]

Two new varieties of sugar beet, M.W. 111 and M.W. 131, both resistant to leaf spot [*Cercospora beticola*: *R.A.M.*, 32, p. 354], have been produced and tested since 1947 in the Arkansas River Valley, Colorado.

Bronner (G.). **Europäische Zusammenarbeit bei der Bekämpfung der Cercospora.** [European co-operation in the control of *Cercospora*.]—*Zucker*, 6, 11, pp. 259–260, 1953.

A brief retrospect of the organization and progress of European co-operation in the control of beet leaf spot (*Cercospora beticola*), necessitated by the rapid northward spread of the disease during the last two decades, is followed by an outline of the programme adopted for Australia [*R.A.M.*, 32, p. 56] in 1953, which was based on breeding for resistance and treatment with copper sprays. Spraying proved too costly for regions where the crop is widely distributed over a small total acreage and the cultivation of the resistant Kleinwanzleben CR was proposed as an alternative. In districts where spraying is done by the farmers themselves, the use of

semi-resistant varieties, e.g., CLR and CR242/53, which tolerate reasonably long spray intervals, is recommended. On the other hand, high-yielding, susceptible varieties may be planted in areas where three or four treatments can be given, using a total of not less than 10 kg. of a 50 per cent. copper dust. Crosses with *Beta maritima* had unsightly, 'leggy' roots and gave poor yields.

McFarlane (J. S.). **Breeding for resistance to downy mildew in Sugar Beets.**—*Proc. Amer. Soc. Sug. Beet Tech., 1952*, pp. 415–420, [? 1952. Received 1953.]

In experimental work at Salinas, California, it was shown that the progeny of sugar beet selections resistant as seedlings to heavy infections of downy mildew (*Peronospora schachtii*) [see above, p. 195 and next abstract] in the greenhouse were also resistant in the field. The most resistant selections were C075, C715, C065, the inbreds P2–20, –4, –16, and –10, and P3–9. Sugar beet is heterozygous for mildew resistance, and the greatest gains in resistance were made by selecting in self-fertile lines rather than in cross-pollinated varieties and selections.

McFarlane (J. S.) & Price (C.). **A new non-bolting curly-top-resistant Sugar Beet variety, U.S. 75.**—*Proc. Amer. Soc. Sug. Beet Tech., 1952*, pp. 384–386, 1 fig., [? 1952. Received 1953.]

A new variety of sugar beet, U.S. 75, has been bred from two successive selections from U.S. 22/3 at Salinas, California, and is recommended for autumn planting in districts where curly top [virus: *R.A.M.*, 33, p. 6 and following abstracts] is prevalent. Yield and sucrose production of this variety are similar to those of other widely grown commercial varieties. Under conditions favourable for downy mildew [*Peronospora schachtii*: see preceding abstract] in the springs of 1950 and 1951, U.S. 75 was considerably more resistant (31 and 34 per cent. infection) than U.S. 22/3 (50 and 42).

Murphy (A. M.) & Savitsky (V. F.). **Breeding for resistance to curly top in hybrids with monogerm Beets.**—*Proc. Amer. Soc. Sug. Beet Tech., 1952*, pp. 387–389, [? 1952. Received 1953.]

In breeding work in Utah and Idaho carried out by the Division of Sugar Plant Investigations in co-operation with the Curly Top Resistance Breeding Committee, the monogerm beets SLC101 and SLC107 were crossed with the multigerm, curly top resistant, self-sterile strains SL92, SL824, SL88–3, SL941, and the non-bolting variety U.S. 75 [see preceding abstract]. Material from the F_2 generation is being selected which shows a high resistance to curly top virus [see following abstracts] combined with the monogerm character.

Murphy (A. M.), Ryser (G. K.), & Owen (F. V.). **Performance of F_1 hybrids between curly-top-resistant and curly-top-susceptible Sugar Beets.**—*Proc. Amer. Soc. Sug. Beet Tech., 1952*, pp. 390–392, [? 1952. Received 1953.]

The F_1 hybrids between male-sterile sugar beets resistant to curly top [virus: see preceding and following abstracts] and susceptible varieties are intermediate in curly top resistance but produced good yields under exposure to moderate curly top infection at Twin Falls, Idaho, and Salt Lake City, Utah, in 1951. One of the F_1 hybrids between Klein E from Germany and a curly top resistant male sterile variety produced yields higher than U.S. 22/2 under severe curly top exposure at Jerome, Idaho. Some of the F_1 hybrids from susceptible varieties produced higher yields than the best resistant combinations.

Giddings (N. J.). **Some host and vector relationships of the curly top virus.**—*Proc. Amer. Soc. Sug. Beet Tech., 1952*, pp. 525–531, 5 figs., [? 1952. Received 1953.]

In this brief review of the host-vector relationships and strains of beet curly top

virus [see preceding and next abstracts], the author discusses the distribution of the vector *Eutettix tenella*, which is confined to areas west of the Rocky Mountains (95° W.), being limited only by the fact that it cannot withstand a colder and more humid climate.

LACKEY (C. F.). **Anatomical studies of injury to Sugar Beets induced by three strains of the curly top virus.**—*Proc. Amer. Soc. Sug. Beet Tech., 1952*, pp. 532–539, 2 figs., [? 1952. Received 1953.]

The effects of strains 1, 6, and 22 of beet curly top virus [*R.A.M.*, 29, p. 548 and preceding abstracts] on sugar beet are described and illustrated. Strain 1 produces severe symptoms on susceptible varieties, killing young plants. In the root tips the virus causes degeneration and necrosis of cells surrounding the sieve tubes. Strain 6 induces less veinlet clearing or distortion than the other strains but dwarfs the entire plant by killing root tips; the necrotic areas are larger than those caused by strain 1. Strain 6 is destructive to susceptible beets. Strain 22, collected from Jerome, Idaho, is injurious to both susceptible and resistant sugar beets, causing severe vein roughening and leaf distortion and extreme hypertrophy and necrosis of the phloem cells in the petiole. In the root tips, however, only a few cells are mildly disorganized.

HILLS (F. J.) & LEACH (L. D.). **The effect of certain soil-row treatments on damping-off of Sugar Beet seedlings caused by specific fungi.**—*Proc. Amer. Soc. Sug. Beet Tech., 1952*, pp. 549–553, [? 1952. Received 1953.]

Greenhouse trials were conducted in California to determine the effectiveness of certain soil row spray treatments in controlling damping-off of sugar beet seedlings [see following abstracts] caused by *Pythium ultimum* and *P. aphanidermatum* [cf. *R.A.M.*, 32, p. 356], *Rhizoctonia* [*Corticium*] *solani* [27, p. 344], and *Aphanomyces cochlioides* [see above, p. 195]. Compounds such as arasan SF and vancide 51, used as a soil row spray, are superior in controlling these pathogens to the standard seed treatment [32, p. 356]. A promising method of application is to spray the fungicide into the row as the seed is sown.

DOWNIE (A. R.), SCHUSTER (M. L.), & OLDEMEYER (R. K.). **Cooperative field testing of strains of Sugar Beets for resistance to several root rotting organisms.**—*Proc. Amer. Soc. Sug. Beet Tech., 1952*, pp. 557–561, 1 fig., [? 1952. Received 1953.]

Various strains of sugar beets were tested in several parts of the United States in 1950 and 1951 on soils naturally infested with the fungi causing different root rots, *Aphanomyces cochlioides* [see preceding abstract], *Rhizoctonia* [*Corticium*] *solani*, [loc. cit.], southern root rot (*Sclerotium rolfsii*) [*R.A.M.*, 32, p. 353], and *Fusarium* yellows (*F. conglutinans* var. *betae*) [cf. 31, p. 265 and next abstract]. Strain A.C.S. 9–604–0 was resistant to or tolerant of *A. cochlioides*, *C. solani*, and *S. rolfsii*, while G.W. 304 was resistant to *C. solani* and *F.* yellows. The selection Nebraska 525 was resistant to *A. cochlioides* and more so to *C. solani* than its parent G.W. 526. The results of these preliminary tests show the possibility of combining resistance to several root-rot organisms in a single sugar beet variety.

GERHOLD (N. R.), HENDERSON (W. J.), & TWOMEY (J. A.). **Soil treatment for control of black-root of Sugar Beets.**—*Proc. Amer. Soc. Sug. Beet Tech., 1952*, pp. 554–556, 1 fig., [? 1952. Received 1953.]

Pre- and post-emergence damping-off of sugar beets [see preceding abstracts] in eastern Colorado is caused by *Pythium* sp., *Rhizoctonia* sp., and *Fusarium* sp., one or more of which may cause a black-root condition. Soil disinfectant materials, such as arasan, dow D.H.A., and dithane Z-78, were applied at the rate of 4 lb.

acre at the time of sowing by means of a Planter Junior which performed the two operations. These treatments significantly increased the stand of sugar beet seedlings in infested soils, arasan giving the best results in tests over three years (1949–51).

Afanasiev (M. M.) & Morris (H. E.). **Resistance and soil treatment for control of Rhizoctonia of Sugar Beets.**—*Proc. Amer. Soc. Sug. Beet Tech., 1952*, pp. 562–567, [? 1952. Received 1953.]

During 1950 and 1951 sugar beet varieties were tested at the Huntley Branch Station, Montana, for resistance to *Rhizoctonia* [see preceding abstracts]. None seemed to have any significant resistance, though 304R showed the lowest incidence of *Rhizoctonia*. Greenhouse and field experiments with various nutrients and soil fungicides were largely negative in controlling the pathogen.

Morris (H. E.) & Afanasiev (M. M.). **The effects of preceding crops and nutrients on the growth and seedling diseases of Sugar Beets in Montana.**—*Proc. Amer. Soc. Sug. Beet Tech., 1952*, pp. 568–570, [? 1952. Received 1953.]

Tests were carried out at the Huntley Branch Station, Montana, on the effect of the previous crop (grown for five years) on the incidence of [unspecified] seedling diseases in sugar beets [see preceding abstracts] subjected to different fertilizer treatments. In 1950 incidence was lowest after fallow (10·6 to 23 per cent. diseased seedlings) and potatoes (15·4 to 20·9) and highest after beet (44·5 to 71·9). In 1951 beets were planted again in all the plots and disease was lowest in those with preceding maize (15·1 to 41·1) and oats (19·2 to 28·6) and highest following beet (13·3 to 44·7) and lucerne (14·5 to 54·9).

Zogg (H.). **Zucker- und Runkelrüben mit Gürtelschorf.** [Sugar and Fodder Beets with girdle scab.]—*Mitt. schweiz. Landw.*, 1, 11, p. 176, 1 fig., 1953.

The autumn of 1953 was marked by severe outbreaks of girdle scab (*Actinomyces* spp.) [cf. *R.A.M.*, 31, p. 536] on beets in many parts of Switzerland. The disease is reputed to be favoured by cold, damp weather in the spring. Direct control is impracticable, but the soil should be thoroughly aerated during the growing period and a crop rotation of several years practised.

Gaskill (J. O.). **Progress report on breeding for storage-rot resistance in Sugar Beets.**—*Proc. Amer. Soc. Sug. Beet Tech., 1952*, pp. 396–399, [? 1952. Received 1953.]

In further breeding work on sugar beets for resistance to [unspecified] storage rot [*R.A.M.*, 30, p. 596] samples from 19 progenies of roots selected for resistance in 1949 were tested in 1950 by storage at 65° and 45° F. for 13 and 16 weeks, respectively. In six of the progenies the average percentage of rotted tissue (by weight) was significantly less than in the parent variety. These results confirm an earlier tentative conclusion [loc. cit.] that storage rot resistance [see following abstracts] can be improved by breeding.

Nelson (R. T.) & Oldemeyer (R. K.). **Preliminary studies applicable to selection for low respiration and resistance to storage rots of Sugar Beets.**—*Proc. Amer. Soc. Sug. Beet Tech., 1952*, pp. 400–406, 2 figs., [? 1952. Received 1953.]

Methods are described for comparing the respiration rates and storage rot resistance [see preceding and next abstracts] of individual sugar beet roots, carried out at the Great Western Sugar Company's Station, Longmont, Colorado. Generally speaking, the higher the sucrose content of a root the higher the resistance to storage rots (*Phoma betae* [*R.A.M.*, 30, p. 596 and next abstract] was used in these tests). Valid selections from inbred lines can be made by these methods, but

selection on the basis of individual root analysis of open-pollinated varieties should be further proven by progeny tests.

GASKILL (J. O.). **A study of two methods of testing individual Sugar-Beet roots for resistance to storage pathogens.**—*Proc. Amer. Soc. Sug. Beet Tech., 1952*, pp. 575–580, 2 figs., [? 1952. Received 1953.]

Slices from 55 comparable sugar beet roots of the commercial variety U.S. 226 were inoculated either by an 'interior' inoculation method, drops of inoculum being placed on the freshly exposed surface, or by a 'peeled surface' one, in which the outermost layers were peeled off to a depth of 1 to 2 mm. before inoculating, the test fungi being *Phoma betae* [see preceding abstract] and *Botrytis cinerea* [see next abstract]. From these experiments it was concluded that roots differed considerably in the average rate of rotting, that, with a few exceptions, a root resistant to one of the cultures tended to be resistant to them all, and that the *Botrytis* culture was more virulent than either of the two *P. betae* used. The depth of rotting in the second method was about half that induced by the first. It seems probable that the techniques described are suitable for storage-rot resistance selections, which need to be confirmed subsequently by progeny tests.

GASKILL (J. O.) & SELISKAR (C. E.). **Effect of temperature on rate of rotting of Sugar Beet tissue by two storage pathogens.**—*Proc. Amer. Soc. Sug. Beet Tech., 1952*, pp. 571–574, [? 1952. Received 1953.]

During investigations of the rotting and heating of sugar beet storage piles in 1950, *Rhizopus oryzae* [*R.A.M.*, 22, p. 508] was isolated from a pile in northern Colorado. In laboratory tests at Colorado Agricultural Experiment Station, Fort Collins, in 1951 the average rate of rotting of interior root tissue by *Botrytis cinerea* [cf. 33, p. 7 and preceding abstract] did not vary appreciably between 40° and 80° F., whereas the rate for *R. oryzae*, which is classed as an active pathogen, varied from a negligible amount at 40° to more than four times that of *B. cinerea* at 83°. The results indicate that at least one species of *Rhizopus* is probably a direct cause of rotting in commercially stored sugar beets in the United States when temperatures are relatively high.

MORGAN (N. G.). **Spray application problems: VI. A laboratory technique using Botrytis fabae on Broad Bean for the biological evaluation of fungicidal spray deposits.**—*Rep. agric. hort. Res. Sta. Bristol, 1952*, pp. 99–102, 1 pl., 2 figs., 1952.

A description is given of a technique, developed at Long Ashton Research Station, using *Botrytis fabae* on broad bean [*R.A.M.*, 32, p. 491; 33, p. 101], for evaluating copper spray deposits on the leaves. Bean plants in pots or detached leaves were treated in the field or laboratory with the fungicide and allowed to dry. They were then uniformly covered with, or treated with separate droplets of, a spore suspension of *B. fabae* by means of a spray tower or a small spray gun and kept in individual moist chambers (21°±2° C.) for 16 hours. The effect of the copper deposit on lesion distribution and measurements was assessed 16 to 24 hours after inoculation.

The method proved useful as a biological check on chemical analysis of fungicide deposits and on indicator methods and for investigating the factors influencing efficiency of deposits obtained by different application methods.

VIENNOT-BOURGIN (G.). **Un parasite nouveau de l'Oignon en France: Botrytis squamosa Walker et sa forme parfaite, Botryotinia squamosa sp. nov.** [A new parasite of the Onion in France: *Botrytis squamosa* Walker and its perfect state, *Botryotinia squamosa* n.sp.]—*Ann. Inst. Rech. agron.*, Sér. C (*Ann. Épiphyt.*), 4, 1, pp. 23–43, 1 pl., 2 figs., 1953.

Infection of white-skinned onions by *Botrytis squamosa* [see next abstract] usually

begins in the upper part of the outermost leaf. A white, oval spot appears and soon covers the entire width of the blade, which curves over. The lesion then spreads towards the tip, and the end whitens and hangs down. As the destruction of the blade progresses, continuous or discontinuous series of white or greyish, longitudinally elongated spots 0·5 to 2 mm. long appear on the green parts. They are bordered by an apparently oily margin, sometimes in the form of a very regular ring. In mature leaves (which are those most frequently attacked) the spots in the basal part remain isolated and distinct. In the final stage conidia are produced on the white parts, and the isolated spots turn blackish at the margin. When the older leaves have been destroyed, infection spreads to the younger ones, plant vigour is reduced, and growth of the bulb retarded.

Apothecia were obtained in culture at the Institut National Agronomique, Paris, after two months on Kauffmann's medium and three and a half on Czapek's, one, seldom two, per sclerotium being formed. Each shortly stalked apothecium, dark chamois brown, darker when dry, measures 3 to 5 mm. in diameter. When mature it is slightly convex with a very thin, almost transparent edge. The hypothecium is composed of polyhedral cells with thick walls. The paraphyses, hyaline and filiform at the base and faintly brownish and claviform or slightly thickened at the round or somewhat truncate apex, are 80 to 110 μ long. The asci, pediform at the base, measure 90 by 10 to 13 μ; the lemon-shaped ascospores measure 11·17 by 8·11 μ. This perfect state is named *Botryotinia squamosa* n.sp.

Leaf inoculations of Barletta and Vaugirard onion plants produced perceptible symptoms in seven days at 14° C. Tissue infection was of two kinds: (*a*) small, whitish, oval, local spots in which the mycelium grew and formed numerous appressoria, or became localized with the production of one or several conidiophores; (*b*) much larger spots developing rapidly and reaching a length of 12 to 30 mm., some physiological disturbance apparently occurring; the blade often broke. When seedlings of the varieties 'jaune paille des Vertus', 'rouge pâle de Niort', and Mulhouse, which have coloured skins, were inoculated with the same strain, the mycelium proliferated in contact with tissues injured by the prick, but failed to penetrate deeper. Occasionally, a few small spots developed, but healing was rapid and no conidiophores formed. Attempts to infect the leaf blades of young *Allium ursinum* plants also gave negative results.

Viennot-Bourgin (G.). **Une maladie à sclérote des bulbes et des feuilles d'Oignon, nouvelle pour la France.** [A sclerotial disease of Onion bulbs and leaves new to France.]—*C.R. Acad. Agric. Fr.*, 39 [? 38], 14, pp. 569–570, 1952.

Most of this information on *Botrytis squamosa* on onions in France has already been noticed from other sources [*R.A.M.*, 32, p. 417 and preceding abstract].

Page (O. T.). **Botrytis spot of Onion leaves in Ontario.**—*Plant Dis. Reptr*, 37, 10, pp. 513–514, 1 fig., 1953. [Multilithed.]

A foliage disease of Yellow Globe onions, agreeing closely in symptomatology with that noticed in England [*R.A.M.*, 23, p. 161], was observed in 1951 in the Garner and Fertile districts of Iowa and in 1952 and 1953 in the Holland-Bradford Marsh, Ontario. Squamose sclerotia were found only occasionally on the bulbs of White Globe onions. *Botrytis squamosa* [see preceding abstracts], isolated from leaf spots in all three years, is believed to be responsible for the disease.

Schmidt (Trude). **Alternaria porri (Ell.) Neerg. als Erreger einer Blattfleckenkrankheit an Porree.** [*Alternaria porri* (Ell.) Neerg. as agent of a leaf spot disease on Leek.]—*PflSchBer.*, 10, 1–2, p. 14, 1953.

Leek plants from Styria submitted for inspection at the end of August, 1952,

were found to be infected by *Alternaria porri* [*R.A.M.*, 25, p. 581]. This is the first record of the fungus in Austria.

STOREY (I. F.) & WILCOX (H. J.). **Centrospora acerina on Celery.**—*Plant Path.*, 2, 2, p. 72, 2 figs. (between pp. 54 and 55), 1953.

Centrospora acerina [*R.A.M.*, 31, p. 269] was identified on several celery crops at Maulden, Bedfordshire, in November, 1952, a new record for England. It proved pathogenic to mature celery plants. *Pythium* sporangia were also present on many of the young roots.

DOOLITTLE (S. P.) & ZAUMEYER (W. J.). **A Pepper ringspot caused by strains of Cucumber mosaic virus from Pepper and Alfalfa.**—*Phytopathology*, 43, 6, pp. 333–337, 1 fig., 1953.

A virosis affecting chilli pepper (*Capsicum frutescens*) in Maryland, Delaware, New Jersey, and contiguous States is characterized by ring markings on the foliage and fruit. It is caused by a strain of cucumber mosaic virus (abs. in *Phytopathology*, 42, p. 7, 1952) and may also be caused by a very closely related strain recovered from lucerne leaves collected in Idaho.

Both strains induce similar characteristic symptoms on the Samsun variety of Turkish tobacco, consisting of greyish-white, circular, local lesions, 3 to 5 mm. in diameter, or smaller in the case of the lucerne strain, taking the form of either broad rings with small centres or solid spots; oak-leaf patterns may also develop, especially from the cucumber strain. The leaves just above those inoculated display a marked yellow-green veinbanding, which fades in the later growth to a green stippled mottle. Only the inoculated leaves develop etch or necrosis. *Datura stramonium*, eggplant, and *Phaseolus acutifolius* var. *latifolius* also reacted to inoculation by local symptoms only, but a number of other plants tested, including bean (*P. vulgaris*), *Melilotus alba*, crimson clover, cowpea, pea, sweet pea, and tomato contracted systemic infection. The Longstanding Bloomsdale spinach variety was also susceptible to both strains, but Old Dominion was attacked only by the lucerne isolate.

The physical properties of the chilli and lucerne collections agree with those of the type strain of cucumber mosaic virus, and in zinnia they confer protection against Price's test strain of cucumber mosaic virus [*R.A.M.*, 14, p. 812; 31, p. 166]. They differ in host range and symptomatology from other strains of cucumber mosaic virus known to cause systemic symptoms on beans [cf. 20, p. 334; 30, p. 135]. The strain of lucerne mosaic virus responsible for a ring spot of chilli in Ontario, Canada [27, p. 187], is distinguishable from the cucumber mosaic strains under observation in host range, thermal inactivation point, and, in part, in symptomatology.

DALE (W. T.). **The transmission of plant viruses by biting insects, with particular reference to Cowpea mosaic.**—*Ann. appl. Biol.*, 40, 2, pp. 384–392, 1953.

In experiments at the Imperial College of Tropical Agriculture, Trinidad, to elucidate certain features of the virus-vector relationship of cowpea mosaic [*R.A.M.*, 29, p. 192; 32, p. 358], transmitted by *Ceratoma ruficornis*, single beetles starved for 24 hours were caged for varying periods on diseased cowpeas, transferred directly to healthy plants for three hours, and thereafter transferred daily to successive healthy plants for the same period. For trials involving prolonged infection feeding beetles were kept on diseased plants for a week or more before direct transfer to healthy plants.

The results obtained demonstrated that infective ability decreased with increase of time after feeding on infected plants, though it persisted for 14 days. The

beetles transmitted more consistently after long feeding periods than after short ones, but feeds of less than five minutes were sufficient. The proportion of plants infected increased with amount of feeding damage incurred. Fasting before feeding had no effect on ability to transmit the virus. Cowpeas were infected by inoculation with macerated infective vectors or with regurgitated juice.

Conroy (R. J.). **Fusarium foot rot of cucurbits in New South Wales.**—*J. Aust. Inst. agric. Sci.*, 19, 2, pp. 106–108, 2 figs., 1953.

A foot rot of pumpkin (*Cucurbita maxima*), squash, and vegetable marrow caused by *Fusarium* [*Hypomyces*] *solani* f. *cucurbitae* [*R.A.M.*, 21, p. 224; 26, p. 162; 28, p. 436] has been recorded in New South Wales on a number of occasions since 1947. The economic importance of the disease appears to depend primarily on the amount of infected seed distributed. The first record was made in the Manning River area, central North Coast, and a survey here in January, 1953, revealed that the disease has occurred sporadically in cucurbit crops over the last ten years, sometimes causing appreciable losses to the individual seed-producer. Up to 30 per cent. seed infection (7 per cent. internal) was detected in seed lots of Queensland Blue pumpkin. Outbreaks of the disease in cucurbit crops have been traced to the sowing of infected seed.

Inoculation experiments with an isolate from squash demonstrated that several varieties of pumpkin, squash, marrow, and watermelon, and Red Seeded citron (*Colocynthis citrullus*) [*Citrullus colocynthis*] were very susceptible; rock-melon (*Cucumis melo*) and cucumber varieties were less so, but individual varieties differed in their susceptibility. Choko (*Sechium edule*) was not susceptible to the isolate used.

Gibson (I. A. S.). **Crown rot, a seedling disease of Groundnuts caused by Aspergillus niger.**—*Trans. Brit. mycol. Soc.*, 36, 3, pp. 198–209, 1 pl., 1 graph, 1953.

Field observations on crown rot of groundnut seedlings caused by *Aspergillus niger* [*R.A.M.*, 33, p. 66] were made at Urambo, Tanganyika, from 1949 to 1951, supplemented by laboratory experiments at Cambridge. The disease is characterized by wilting and sudden death accompanied by yellow-brown rotting of the hypocotyl, which eventually turns black. It occurred only in the large-scale plantings of the Overseas Food Corporation, where incidence was generally low; no infection was observed in native plantings. Typical lesions were produced by inoculating Natal Common hypocotyls with mycelium but no infection resulted from the use of conidia alone.

From field observations it is suggested that natural infection occurs chiefly by (*a*) contact between a previously infected cotyledon and the hypocotyl during emergence, (*b*) contact of the hypocotyl with *A. niger* established in organic soil debris, and (*c*) in slightly older seedlings, through previously infected cotyledons dropping off and leaving bases from which infection may spread to give a true collar rot.

A study of five isolates falling within Thom and Raper's *A. niger* group, namely, 7 and 29 (both typical *A. niger*) from groundnuts in East Africa, 15 (subsequently identified as *A. foetidus*) from a sector of a culture very similar to 29, 28 (*A. awamori*) from Cambridge, and 34 (*A. violaceo-fuscus*) from tea flowers in Assam, showed that pathogenicity to groundnut seedling hypocotyls was closely related to oxalic acid production. Lesions were produced by treatment with growth substances of the pathogenic isolates 7, 15, and 29 produced in agar culture and also with pure oxalic acid in comparable concentration.

The optimum temperature for growth on agar was 37° C.; seedlings raised at 30° to 37° were most disposed to severe and rapid crown rot infection Disease development was also favoured by a light soil texture and high soil moisture content.

Drummond-Gonçalves (R.). **A bacteriose e a Mandioca Guaxupé.** [Bacteriosis and the Guaxupé Cassava.]—*Biológico*, 19, 6, pp. 114–117, 1 fig., 1953.

Particulars are given of observations and experiments in São Paulo, Brazil, demonstrating the resistance to *Xanthomonas manihoti* of the Guaxupé forage variety of cassava [*R.A.M.*, 31, p. 589].

Wilhelm (A. F.). **Methoden zur Prüfung von Pflanzenschutz- und Vorratsschutzmitteln XLVII. Methoden zur Prüfung von Mitteln gegen die Traubenfäule (Botrytis cinerea).** [Methods for the assay of protectives for plants and stored commodities XLVII. Methods for the assay of remedies against Grape rot (*Botrytis cinerea*).]—*NachrBl. dtsch. PflSchDienst* (*Braunschweig*), *Stuttgart*, 4, 5, pp. 67–71, 1952.

After summarizing the present status of the control of vine grey mould (*Botrytis cinerea*) in Germany [*R.A.M.*, 31, p. 591] and citing some experimental data from the Viticultural Institute, Freiburg-im-Breisgau, to demonstrate the conflicting results hitherto obtained in field trials of fungicides by existing procedures, the author describes laboratory methods of assay using a spore suspension on an agar medium or on vine leaves, and outlines a plan for vineyard tests to be carried out in the damp late summer or autumn months when conditions are conducive to severe infection.

Susceptible varieties should be used, preferably Elbling, Müller-Thürgau, or Portugieser, replications should be as numerous as possible, and each plot large enough for 25 vines. For evaluation the infection of each grape is assessed in relation to the total number attacked and expressed in tenths, which are added up. The result, divided by the number of grapes in the count (500) and multiplied by 100, gives the percentage of infection.

In one test in 1950 the infection percentage was reduced from between 5·3 and 13 per cent. on the controls to 3·16 on those sprayed with 4 per cent. Ob21 plus 0·2 per cent. shellestol and to 4·1 for the same plus 0·15 per cent. trytinit.

Yarwood (C. E.). **Quick virus inoculation by rubbing with fresh leaf discs.**—*Plant Dis. Reptr*, 37, 10, pp. 501–502, 1953. [Multilithed.]

A new, rapid method of virus inoculation [cf. *R.A.M.*, 32, p. 607] consists in rubbing the cut edges of leaf disks from the source plant over test leaves previously dusted with carborundum and sprayed with potassium monohydrogen phosphate. One disk may be used, or several (optimum four) stacked together and trimmed to a straight edge. At the Department of Plant Pathology, University of California, Berkeley, the method was particularly successful with unstable viruses, more infections being obtained on bean [*Phaseolus vulgaris*] inoculated with tomato spotted wilt from tobacco [31, p. 317] and with apple mosaic virus [23, p. 391; 33, p. 88] than by the conventional method using leaf sap.

Gol'din (M. I.). Мозаика у Подорожника. [*Plantago* mosaic.]—Докл. Акад. Наук СССР [*C.R. Acad. Sci. U.R.S.S.*, N.S.], 88, 5, pp. 933–935, 2 figs., 1953.

Studies at the Institute of Microbiology, Academy of Sciences, [? Moscow], U.S.S.R., on the mosaic virus of plantain (*Plantago major*) [*R.A.M.*, 21, p. 227] indicate that it differs distinctly in chemical constitution from tobacco mosaic virus, particularly in the content of aromatic amino acids and sulphur (three times more in *Plantago* mosaic virus). The latter is easily sap transmitted to tobacco, tomato, and *Plantago*, necrotic spots (2 to 3 mm. in diameter) appearing on infected leaves in three to four days and finely patterned mosaic symptoms in seven to ten. *Nicotiana glutinosa* and petunia reacted to both *Plantago* mosaic and tobacco mosaic with local necrosis only.

Addition of 0·1 N hydrochloric acid to plant tissues dissolved the characteristic crystalline inclusions, which were stained bright red with fuchsin and green with Janus green.

The differences in the reactions of tomato and *Plantago* to *Plantago* mosaic virus are reflected in the morphology of the cell inclusions.

MATTHEWS (R. E. F.). **Factors affecting the production of local lesions by plant viruses. 1. The effect of time of day of inoculation.**—*Ann. appl. Biol.*, 40, 2, pp. 377–383, 2 graphs, 1953.

At the Plant Diseases Division, Auckland, New Zealand, under uncontrolled glasshouse conditions between March and May, a different group of potted Sydney Wonder bean (*Phaseolus vulgaris*) plants was inoculated with a tobacco necrosis virus isolated from lettuce [*R.A.M.*, 32, p. 359] every two hours over a 24-hour period. In two experiments the numbers of local lesions per half leaf increased during the morning, reached a maximum in the afternoon, and later fell to a minimum (6 a.m. and 4 a.m. in the two experiments, respectively). In the second experiment there was a significant rise between 4 a.m. and 6 a.m., though at 6 a.m. there was no detectable increase in light intensity, light being first registered 40 minutes later.

Tobacco mosaic virus in *Nicotiana glutinosa* and lucerne mosaic virus (isolated from clover) and turnip mosaic virus in White Burley tobacco produced similar but smaller effects. Such diurnal variations could, if not eliminated, affect the results of quantitative experiments with local-lesion counts. Further work on the effects of light and temperature may make it possible to define conditions for raising plants which will not display a continuous change in susceptibility.

SCHRAMM (G.). **Chemie der Viren.** [The chemistry of viruses.]—*Klin. Wschr.*, 31, 9–10, pp. 198–205, 6 figs., 3 diags., 3 graphs, 1953.

This is a review of the latest information on the chemistry of viruses, including tobacco mosaic, potato virus Y, and others affecting plants.

Thirty-third Report of the National Institute of Agricultural Botany, Cambridge, 1952.—44 pp., 1952.

In the mycology section (pp. 18–20) of this report [cf. *R.A.M.*, 32, p. 172] it is stated that in 1952 wheat yellow rust [*Puccinia glumarum*: see below, p. 220] was unusually prevalent in many parts of Great Britain, severely attacking certain varieties. Cappelle Desprez, however, even under these conditions again out-yielded Nord Desprez. In plot tests at Cambridge in a severe natural outbreak Miana, Juliana, Magdalena, Als, Ministre, Hybrid 46, King II, Evolution, and Alexander were free from the disease while Bersee, Later, Yga Blondeau, Welcome, Atle, Mansholts 25, Glasnevin Rosa, Hybride de Lobeau, Chanteclair, Suzanne Favereau, Little Joss, Redman, Rampton Rivet, and 255/40 had only 0·1 per cent. infection. Race 2B, a new biotype of race 2 of *P. glumarum* but more virulent and attacking several varieties resistant to race 2, was identified on material from east England. Greenhouse resistance trials have shown that varieties resistant as seedlings remain resistant in maturity, while those susceptible as seedlings are not necessarily susceptible when mature, e.g., Little Joss. Nord Desprez, Eclipse, and Cappelle Desprez are all susceptible to race 2B, but Staring, Hybrid 46, Hybride de Lobeau, Glasnevin Rosa, and Ministre appear to be fairly resistant to races 2, 2B, 5, and 8.

Of the 22 wheat varieties tested against loose smut [*Ustilago tritici*: loc. cit.] many were resistant, e.g., Vilmorin 27, Vercors, and Fylgia, at least to the sources of smut used, but it is suspected that more than one physiologic race of the fungus is present in the country.

One-sixth of the total rejections of barley was due to loose smut [*Ustilago nuda*: loc. cit.; 31, p. 324], many of them Scandinavian varieties.

From the potato branch (pp. 20–24) it is reported that Ulster Leader, tested at many centres, proved to be so susceptible to dry rot [*Fusarium caeruleum*: 32, p. 502] that it was very difficult to obtain sufficient sound 'seed' for planting. At centres where blight [*Phytophthora infestans*] was late the foliage of the resistant variety Orion showed symptoms of attack, indicating the presence of the B group of strains of the fungus [see below, p. 250] to which its foliage is susceptible. During the season 4,477 tests for virus infection were made on potato seed stocks in Northern Ireland and Scotland by inoculation to *Datura* and *Nicotiana* species, the level of testing varying from leaf samples to group testing. Glasshouse tests revealed the occasional presence of potato virus X [29, p. 274; 33, p. 109] in supposedly virus-free stocks at Headquarters, Northern Ireland, and in the Tarr Head district, Co. Antrim. The health and type of the stocks were otherwise satisfactory, all crops receiving S.S. certificates.

Of the 97 samples of celery (p. 28) tested for the presence of *Septoria apii-graveolentis* [31, p. 264], 40 per cent. was free from the disease and 38 per cent. showed 1 to 5 per cent. infection, the remainder being considerably more infected.

Böning (K.). **Pflanzenschutz.** Ex **50 Jahre Bayerische Landesanstalt für Pflanzenbau und Pflanzenschutz.** [Plant protection. *Ex* 50 years of the Bavarian State Institute for Agriculture and Plant Protection.]—*Landw. Jb. Bayern, 1952*, 29, *Suppl.*, pp. 91–155, 7 graphs, 2 maps, 1952.

The following information, besides items already noticed from other sources, is presented in this report. F. Hinke and Astrid v. Minckwitz (pp. 96–98) describe the work of testing plant protectives and equipment for their application. In 1952 nearly 380 seed disinfectants were analysed (40 in 1946) and over 80 fungicides (60 in 1949); 48 spraying and dusting machines were tested.

F. Sprau (pp. 98–100) describes an extension of the eye cutting (leaflet) method of potato virus diagnosis [*R.A.M.*, 32, p. 612] to tests for blight (*Phytophthora* [*infestans*]), powdery scab [*Spongospora subterranea*], scab (*Actinomyces scabies*), and spraing in samples of consignments for export. Further work on potato viroses is reported by F. Sprau, H. Brandt, O. Ziegler, and W. Nowak on pp. 110–113, and on the other above-mentioned diseases by F. Sprau on pp. 113–114.

Investigations on cereal diseases by F. Wagner and F. Hinke (pp. 105–107) included experiments on the control of wheat dwarf bunt (*Tilletia tritici nanifica*) [*T. brevifaciens*: see following abstracts] by seed disinfection [see below, p. 224] and the development of resistant varieties. Two resistant North American varieties, Relief and Wasatch, displayed a comparable reaction to the Bavarian physiologic races of dwarf bunt and may well prove to be of practical use as progenitors in crosses with local selections. The resistance of Wasatch to ordinary bunt [*T. caries*] is a further advantage.

The economically important fodder grass *Arrhenatherum elatius* is attacked in Lower Bavaria and Central Franconia by *Ustilago decipiens* [*U. avenae*: 27, pp. 124, 125], which may be completely eliminated by fungicidal seed treatment (dusting or immersion *in vacuo*).

The control of cereal black rust (*Puccinia graminis*) by barberry eradication [cf. 33, p. 77] presents great difficulties owing to the very wide distribution of the aecidial host, and new hormones and caustics are being tested for this purpose.

Ophiobolus graminis [33, p. 14] and *Cercosporella herpotrichoides* have been gaining much ground of late through neglect of cultural precautions, notably the essential long intervals between cereal crops in the rotation.

In the section on beet diseases (pp. 114–116) N. Malmus reports that fairly heavy attacks of beet leaf spot (*Cercospora* [*beticola*: 33, p. 7]) occurred in the

Lower Bavaria-Upper Palatinate region in 1945 and 1946, severe to very severe in 1947 and 1948, and very severe in 1949 to 1951. Large-scale spraying experiments undertaken in 1951 by four factories in the affected zone resulted in average yield increases per ha. of 68 doppelzentner [1 doppelzentner = 100 kg.] of roots, 243 of leaves, and 15·18 of sugar. The total loss for the year on unsprayed crops was estimated at DM. 1,021 and may be reckoned as about DM. 6,000,000 for Bavaria as a whole, with an almost equally heavy reduction in the fodder beet harvest.

Beet yellows virus [33, p. 193] has not yet made much headway in the main south German centres of cultivation, but is spreading year by year in Lower Franconia and Swabia.

K. Böning (pp. 116–117) states that, though clover sickness in south Bavaria is associated mainly with nematodes, fungi are also implicated to some extent, especially on gravel soils, *Thielavia* [*Thielaviopsis*] *basicola* [25, p. 455; cf. 33, p. 153] being the most important. *Ascochyta imperfecta* is largely responsible for gaps in lucerne stands.

Fruit pathogens listed by H. Brandt and H. Richter (pp. 118–121) include *Polystigma rubrum* [C.M.I. map No. 148] and *Taphrina pruni* on plum, *Gymnosporangium sabinae* on pear, and *Cylindrosporium padi* [*Coccomyces hiemalis*] on cherry [*R.A.M.*, 32, p. 261]; marginal leaf scorch occurs on red currant [19, p. 31] and gooseberry.

A further report by N. Malmus (pp. 129–131) on the results of experiments with copper-containing sprays for the control of potato blight [30, p. 187 and below, p. 251] gives the average figures for yield increase in 1950 as 16·2 per cent. and in 1951 as 15·1. In 1949, 1950, and 1951 spraying raised the yields of the medium-early varieties by 25·2, 11·7, and 20·3 per cent., respectively, the corresponding figures for the early being 0·6, 2·3, and 6·8, respectively. Late varieties also benefited, the average increase in 1950 for 179 tests with Ackersegen being 11·1 per cent., for 23 with Bona 8·2, and for 19 with Böhms Mittelfrühe 8·1, while the corresponding figures for the same varieties in 1951 were 12·4, 23·5, and 11·1, respectively, with the addition of 13·7 for Oberarnbacher Frühe.

Stations fédérales d'essais agricoles de Mont-Calme et Montagibert, Lausanne et Pully. Rapport d'activité 1952. [Report for 1952 on the work of the Federal Agricultural Experiment Stations of Mont-Calme and Montagibert, Lausanne and Pully.]—*Annu. agric. Suisse*, (54) N.S. 2, 6, pp. 755–984, 16 figs., 13 diags., 35 graphs, 5 maps, 1953.

The following are among the numerous items of phytopathological interest in this report [cf. *R.A.M.*, 32, p. 301]. The spread of dwarf bunt of wheat (*Tilletia brevifaciens*) [see preceding and next abstracts] gives cause for alarm, and the local distribution of the disease is wider than was originally supposed.

A severe outbreak of *Alternaria solani* [31, p. 534] on the Saskia potato variety was recorded on 6th June from Céry, near Lausanne, and by mid-July symptoms were almost ubiquitous in the French-speaking cantons. So heavy was the infection in some fields by mid-August that the leaves were entirely covered with lesions. At the end of the season the high percentage of *Alternaria* rot in the tubers resulted in a number of rejections by commercial firms.

No fresh foci of potato wart disease (*Synchytrium endobioticum*) were detected in the area administered by the Stations, where the substitution of immune for susceptible varieties is in progress [cf. next abstracts]. Of a total of 18 registered varieties, 13 are immune, but the susceptible Bintje occupies 60 per cent. of the entire area under potatoes.

G. Trivelli (pp. 941–944) describes the successful application of his method for the assay of retention of the copper sprays used commercially against vine mildew

[*Plasmopara viticola*: 29, p. 38] to an investigation of the discrepancies observed in 1950 between their relative persistence on the leaves and grapes.

R. Gallay, R. Bovey, M. Staehelin, W. Wurgler, and H. Leyvraz (pp. 945–952) propose a mathematical formula for the objective evaluation of court-noué in the vine [30, p. 403]. If the lengths of the successive internodes be designated $m_1, m_2, m_3, \ldots m_n$ and the total length of the shoot L, the index of court-noué

$$I = \frac{(m_1 - m_2)^2 + (m_2 - m_3)^2 \ldots + (m_{n-1} - m_n)^2}{L^2}.$$

Zogg (H.), Horber (E.), & Keller (E. R.). **Pflanzenschutz.** Ex **Bericht über die Tätigkeit der Eidg. landwirtschaftlichen Versuchsanstalt Zürich-Oerlikon pro 1950/51.** [Plant protection. *Ex* Report on the work of the Federal Agricultural Experiment Station Zürich-Oerlikon for 1950–1.] —*Annu. agric. Suisse*, (54) N.S. 2, 1, pp. 53–72, 1953.

The following are among the phytopathological records for 1951 [cf. *R.A.M.*, 31, p. 533 and next abstract]. A small focus of dwarf bunt [*Tilletia brevifaciens*] of wheat, regarded by the authors as being close to *T. tritici* [*T. caries*], was detected for the first time in the Zürich district of Switzerland [cf. preceding abstract]. Ceretan [ceresan] dust at a dosage of 200 gm. per 100 kg. and the wettable mercurials panogen, preparation Y, and preparation Z, applied at the rate of 200 ml. per 100 kg., gave satisfactory control of *T. caries*, with averages of 34, 7·5, 16·8, and 6·2 diseased ears per 10 sq. m., respectively.

Alternaria solani was prevalent on stored Bintje potatoes [loc. cit.]. *Actinomyces scabies* assumed a very troublesome form on low-lying moorland soils. *Synchytrium endobioticum* was confined to Einsiedeln and Val Colla, Ticino. In the former region the change-over to wart-immune varieties is proceeding satisfactorily, but new foci of infection were reported from the latter. The best control of potato blight (*Phytophthora infestans*) in experiments with standard preparations was given by 2 per cent. Bordeaux mixture, which was rated as 'very good', with an average of 24·2 per cent. infection as against 82·9 in the untreated plots, followed by the same at 1·5 per cent. (32·4) ('very good' to 'good'), and the same at 1 per cent., copper oxide at 0·5 per cent. (40·8), and copper oxychloride 50 at 0·6 per cent. (44·7), all good.

Beet leaf spot (*Cercospora beticola*) was fairly prevalent. The ratings of 'very good' and 'good' were assigned, respectively, to Bordeaux mixture at 2 and 1 per cent. in spraying experiments for its control, the former reducing the percentage of infection from 71·1 to 19·4 and the latter to 35·1. Sporadic cases of beet yellows virus [loc. cit.] were observed, but the disease is considered of no practical importance in the country to date [cf. next abstract].

Zogg (H.), Graf (A.), & Keller (E. R.). **Pflanzenschutz.** Ex **Bericht über die Tätigkeit der Eidg. landwirtschaftlichen Versuchsanstalt Zürich-Oerlikon pro 1951/52.** [Plant protection. *Ex* Report on the work of the Federal Agricultural Experiment Station Zürich-Oerlikon for 1951–2.]—*Annu. agric. Suisse*, (54) N.S. 2, 5, pp. 546–561, 1953.

During 1952 [cf. preceding abstract], maize in the Zürich district of Switzerland sustained considerable damage, in the form of stem rot and severe infection of the ears, from various species of *Fusarium* requiring further investigation. *Ustilago zeae* [*U. maydis*: C.M.I. map No. 93] was very prevalent in some localities.

The hot, dry summer of 1952 arrested the spread of potato blight (*Phytophthora infestans*) [see preceding abstracts and below, p. 251] but was all the more conducive to outbreaks of early blight (*Alternaria solani*), which caused extensive tuber spoilage, amounting to 25 to 30 per cent. in some lots stored in commercial ware-

houses. A new focus of wart disease (*Synchytrium endobioticum*) was detected on the Eersteling [Duke of York] variety in the canton of Zürich.

Leaf spot (*Cercospora beticola*) was again very destructive in some of the principal areas of beet cultivation, while beet yellows virus extended its range for the first time. The best control of leaf spot was obtained by spraying with 2 per cent. Bordeaux mixture, while copper oxide and copper oxychloride also gave satisfactory results.

Sarejanni (J. A.), Démétriadès (S. D.), & Zachos (D. G.). **Rapport sommaire sur les principales maladies des plantes observées en Grèce au cours de l'année 1951.** [Brief report on the principal plant diseases observed in Greece during the year 1951.]—*Ann. Inst. phytopath. Benaki*, 6, 1, pp. 5–9, 1952.

This report [cf. *R.A.M.*, 31, p. 224] includes the following items. In the Turnavo (Thessaly) and Corinth districts *Macrophoma flaccida* [*Guignardia baccae*] severely damaged grapes shortly before harvest [28, p. 51]. *Deuterophoma tracheiphila* is severe on citrus all along the northern coast of Peloponnesus [C.M.I. map No. 155] and affects orange trees in Nauplia and Messenia. As oranges are usually resistant the question arises as to whether there are some susceptible varieties or different strains of the fungus. Almond trees at Kapandriti, Attica, and on the island of Keos were severely damaged by *Sclerotinia laxa* [No. 44], which also destroyed the entire apricot crop around Athens by attacking the flowers. Fruits of Japanese medlars [*Mespilus germanica*] at Neapolis, Crete, suffered severe damage by *Fusicladium dendriticum* var. *eriobotryae* [cf. *R.A.M.*, 31, p. 335]. Wheat plants apparently affected by *Ophiobolus graminis* were received in spring from Gratiné (Thrace) and Karditza (Thessaly). The disease, a new record for Greece, caused severe damage in certain fields. *Puccinia triticina* [17, p. 226] was severe in wheat fields in the Messara region of Crete. Spring potatoes on the Messara and Hierapetra plains in Crete suffered severe damage by *Phytophthora infestans* [31, p. 30]. The fungus also caused important losses in the autumn crop in Attica, Boeotia, and Arcadia and around Corinth and Kalamata and on the island of Naxos. *Colletotrichum atramentarium* [C.M.I. map No. 190] severely damaged plantings at Tripolis. Severe disease attacks were recorded on eggplants in seed-beds at Maroussi by *Rhizoctonia* [*Corticium*] *solani* [cf. *R.A.M.*, 32, p. 279]; chick peas [*Cicer arietinum*] in Chalcidice by *Ascochyta rabiei* [32, p. 259]; onions at Thesbiae, Boeotia, by *Peronospora destructor* [C.M.I. map No. 76]; garlic at Distomo by *Puccinia allii* [cf. *R.A.M.*, 30, p. 401]; and carnations at Kiphissia by *Peronospora* sp. [*P.* ? *dianthicola*: 30, p. 40] in the spring.

Fourth Annual Report of the Commonwealth of Australia Scientific and Industrial Research Organization for the year ending 30th June, 1952.—Canberra, 173 pp., 1952. [Received 1953.]

In the plant diseases section (p. 18) of this report [cf. *R.A.M.*, 32, p. 235] it is stated that tomato roots infected with potato virus X [33, p. 46] grown in culture lost the virus after seven months. Potato roots have been successfully cultured as a result of adding coco-nut milk to the medium. In further investigations it was shown that the severe strain of witches' broom virus of lucerne [32, p. 668] is identical with tomato big bud virus [31, p. 125].

Seedling failure in subterranean clover [*Trifolium subterraneum*] in the Ninety-Mile Plain in South Australia was of three kinds, two due to fungi, *Rhizoctonia* [*Corticium*] *solani* [cf. 32, p. 236] causing 'purple patch' disease, and a more widespread 'general unthriftiness' caused by *C. praticola* [*C.* ?*solani*].

Simmonds (J. H.). **Science Branch.**—*Rep. Dep. Agric. Qd, 1950–51*, pp. 46–49, 1951; *1951–52*, pp. 66–70, 1 fig., 1952.

In the 1950–1 report [cf. *R.A.M.*, 30, p. 582] it is recorded that the new biotype of wheat stem rust [*Puccinia graminis*: 32, p. 425] was widespread, particularly

on Yalta and Kendee varieties and less so on Charter, Gabo, Lawrence, and Celebration. Glume blotch (*Alternaria* sp. and *Helminthosporium* sp.), *Erysiphe graminis* [22, p. 351], *Septoria tritici* [24, p. 308], and *S. nodorum* [30, p. 559; 33, p. 21] were more prevalent on wheat than usual, the last less so in Queensland than in some other States. Sorghum kernel smut [*Sphacelotheca sorghi*: 29, p. 202] was practically confined to untreated seed and was less harmful than head smut (*S. reiliana*) [C.M.I. map. No. 69] which was observed for the first time in Queensland in 1950. Linseed pasmo disease (*Sphaerella* [*Mycosphaerella*] *linorum*) [*R.A.M.*, 30, p. 558], another new record, was observed in 1949 and caused serious losses in 1950.

The spread of banana Panama disease (*Fusarium oxysporum* f. *cubense*) [33, p. 98] was checked successfully by careful inspection of all plantations from which planting material is derived. Field evidence indicates that once the plantation is affected the cessation of further soil cultivation reduces the rapidity of subsequent spread. Papaw cultivation was seriously hampered by die-back [29, p. 202].

Bean [*Phaseolus vulgaris*] angular leaf spot (*Isariopsis griseola*) [32, p. 235] was responsible for severe leaf drop and the abandonment of large plantings, while *Sclerotinia sclerotiorum* [29, p. 243] was the most important source of loss in the markets. *Sclerotium rolfsii* [27, p. 47] caused severe losses in one-year-old hoop pine [*Araucaria cunninghamii*] seedlings at Como Forestry Nursery.

New disease records included antirrhinum anthracnose (*Colletotrichum antirrhini*) [17, p. 298] and downy mildew (*Peronospora antirrhini*) [C.M.I. map No. 222]; leaf scorch (*Stagonospora curtisii*) [*R.A.M.*, 27, p. 524] and base rot [*F. bulbigenum*: loc. cit.] of daffodil; and carnation leaf spot (*Septoria dianthi*) [cf. 30, p. 389], which was most harmful, destroying the majority of unsprayed carnations in one locality, and was not easily controlled even by repeated copper sprays.

In 1951–2, owing to record dry weather in spring and early summer, diseases usually common at this time were rare or completely absent, and field control trials yielded little or no results.

Powdery mildew was more serious than usual on wheat though a good crop was harvested. *Septoria nodorum* was again in evidence. *Helminthosporium* blight (*H. victoriae*) of oats [C.M.I. map No. 267] affected Victoria crosses and may render these valueless on the moist river flats.

Potato purple top wilt caused by tomato big bud virus [see preceding and next abstracts] was serious in the autumn crop in several districts, while bacterial wilt [*Pseudomonas solanacearum*: loc. cit.] was more severe in coastal areas.

Incidence of [unidentified] brown spot of Emperor mandarin [loc. cit.; *R.A.M.*, 20, p. 151] was rather low at Burrum. Over three seasons the cuprous oxide schedule including a pre-blossom application has given the best results and was closely followed by cuprous oxide plus zinc. A combination of the two, however, appears to be the most promising method of control. The standard borax-boracic acid plus wax emulsion treatment gave significant control of blue mould [*Penicillium italicum*: 32, p. 310] on Emperor mandarin, but not of stem-end rot (*Phomopsis* [*Diaporthe*] *citri*) [28, p. 453], and caused fruit injury. The latter disease, prevalent in coastal areas, was best controlled with a salicylanilide plus wax emulsion.

Isolated instances of avocado trees dying with symptoms clearly reminiscent of 'decline' [cf. 26, p. 68] have been observed during the past three or four years. In one locality a third of a block of 270 trees died. *Phytophthora cinnamomi* [33, p. 99] was isolated from the affected roots, but so far disease symptoms have not been reproduced by the inoculation of potted plants.

Further investigations on the control of banana leaf spot (*Cercospora musae* [*Mycosphaerella musicola*: C.M.I. map No. 7] and *Cordana musae* [No. 168]) in North Queensland by spraying indicate that there may not be much difference in the number of leaves on sprayed and unsprayed plants, but differences in the

amount of leaf spot may be considerable. As the bunches ripen earlier on unsprayed plants, retarded ripening in itself may save considerable losses during marketing. The use of Lady Finger and Sugar bananas, approved as sources of planting material free from Panama disease for the past three years, has restricted disease spread.

Papaw die-back, causing up to 80 per cent. losses, was severe particularly in plantings in their first and second year of bearing, some of them often succumbing in the pre-flowering stage. No definite evidence of resistance in selected varieties was obtained.

A few bean varieties not normally grown in Queensland proved susceptible to *Pythium* wilt. Susceptibility to rust [*Uromyces appendiculatus*: *R.A.M.*, 31, p. 467], which is becoming serious, halo blight [*Pseudomonas medicaginis* f.sp. *phaseolicola*: 32, p. 235 and next abstract], anthracnose [*Colletotrichum lindemuthianum*: loc. cit.], and bean mosaic virus [32, p. 415] varied. Four strains of Brown Beauty were found to be immune from mosaic and one strain was highly resistant to anthracnose. The yields of bean plots infected with mosaic were 18 per cent. less than healthy ones of the same strain. In studying the problem of trace infections of bacterial diseases in the production of certified bean seed, bacterial brown spot (*P. syringae*) [17, p. 578] was found to be more prevalent than was believed, and a previously unrecorded bacterial disease transmitted by thrips was widespread in seed stocks. Field identification of the various bacterial diseases of beans is considered to be sufficiently practicable to permit a tolerance of the mild diseases, though excluding the serious ones.

Pre-emergence rotting of peas, serious under wet conditions, was readily controlled by seed treatment with tetroc, which does not interfere with *Rhizobium* inoculations [cf. 32, p. 69].

Hoop pine [*A. cunninghamii*] at the Amamoor nursery was attacked by a stem blight (*Phomopsis* sp.), which was checked by a copper spraying programme. Seedling root rot observed on this host in several forestry nurseries was found to be associated with a *Fusarium* sp. which reproduced the disease in pot inoculation experiments.

Plant disease survey for the twelve months ending 30th June, 1952. Twenty-second Annual Report N.S.W. Department of Agriculture. Biological Branch. Division of Science Services.—47 pp., 1 map, [? 1953. Mimeographed.]

This report [cf. *R.A.M.*, 32, p. 174] was compiled from data from the usual sources [loc. cit.].

Sugar-cane losses from disease were estimated at 188 tons, or 0·05 per cent. of the total tonnage crushed. Mosaic virus [33, p. 51] has become increasingly evident in the valuable seedling variety 41 S.N. 3339.

Crown rot of groundnuts (*Sclerotium rolfsii*) [cf. 26, p. 286] was recorded for the first time in the State, from the north coast. *Phytophthora parasitica*, isolated from black shank tobacco plants [cf. 33, p. 70], attacked castor bean plants [*Ricinus communis*] in the glasshouse, but was only weakly parasitic on tobacco. The disease is also recorded from Queensland.

A survey of the citrus losses caused by *P. citrophthora* [30, p. 310] during four years of heavy rain and floods ending in 1951, showed that in the Metropolitan Area 98,000 of 276,000 trees in the Windsor district are dead or unlikely to recover, the figures for the Kurrajong and Asquith districts being 10,000 and for the Gosford-Wyong districts 14,000.

Brown spot of undetermined origin was again highly destructive to Emperor mandarins [see preceding abstract]. The available evidence indicates that the disease may be of bacterial origin. A condition apparently identical with xyloporosis as described in Israel and Florida [32, p. 18] affected three 12-year-old orange

trees. The limb-canker phase of the apple die-back complex due to *Dothiorella* sp. [26, p. 342] reappeared for the first time since the previous drought season (1946–7) and was very severe, especially on the Kirk's Carrington variety. Within each variety intensity of infection appeared to depend upon the degree of drought stress.

Puccinia pruni-spinosae [29, p. 515] was heavy by the end of October on unsprayed apricot trees, though those sprayed with Bordeaux mixture at bud swell were unaffected. Yellow wood rot (*Polystictus versicolor*) [23, p. 25] was present on old apricot trees throughout the State, especially on those still dying from flood effects. Leaf curl (*Taphrina deformans*) [32, p. 668] was the most serious disease of peach on unsprayed or inadequately sprayed trees. Blackburn peach trees adjacent to Wotton heavily infected by shot hole (*Clasterosporium carpophilum*) [32, p. 669] were only very slightly affected. Powdery mildew (*Sphaerotheca pannosa*) was severe on peach trees, the source of inoculum being an adjacent hedge of Dorothy Perkins rose.

The number of banana plants eradicated during the year because of bunchy top virus [32, p. 262] was 3,654. The disease reappeared in two eradication zones after a lapse of some years, three affected plants being found in the Clarence area and a diseased plantation detected at Yarrahappini. Squirter disease (*Nigrospora sphaerica*) has almost disappeared since the introduction of compulsory dipping in salicylanilide before marketing [30, p. 559]. Olive leaf spot (*Cycloconium oleaginum*) [C.M.I. map No. 183] caused severe defoliation.

New disease records for the year included crown rot (*Sclerotium rolfsii*) of *Begonia sutherlandii*, greening ([tomato] big bud virus) of *Campanula lactiflora*, also present on petunia, crown rot (*Phytophthora* sp.) of chrysanthemum, bulb rot (*Pythium splendens*) of *Cymbidium*, rust (*Uromyces scillarum*) on *Scilla*, leaf spot (*Entyloma nymphaeae*) of water-lily, and crown gall (*Agrobacterium* [*Bacterium*] *tumefaciens*) of rhubarb [cf. *R.A.M.*, 26, p. 280]. Gladiolus yellows (*Fusarium orthoceras* f. [var.] *gladioli*) [32, p. 255] appears to have been introduced into New South Wales from Victoria and Holland. Varieties found susceptible, though listed as resistant in the United States, included Picardy, Snow Princess, and Spotlight.

Jacaranda was affected by root rot (*Phytophthora cinnamomi*) and *Primula* by root rot and wilt (*Phytophthora* sp.) [cf. 32, p. 315].

Of 97 bean [*Phaseolus vulgaris*] crops on 416 acres, 86 (271 acres) were passed for certification, three being rejected because of anthracnose (*Colletotrichum lindemuthianum*) [see preceding abstract]. No halo blight (*Pseudomonas* [*medicaginis* f.sp.] *phaseolicola*) [loc. cit.] was seen in seed crops on the south coast. In some bean strains a correlation was observed between seed coat colour and resistance to strain 1 of *C. lindemuthianum* (the American β strain) [3, p. 110], the darker-seeded selections usually being more resistant. Tweed Wonder × Red Mexican and Logan × Granda displayed some resistance to the β and γ strains, though resistance was not always complete. Inoculations with bean yellow mosaic virus [cf. 31, p. 469; 33, p. 7] showed certain Brown Beauty selections to be resistant. A very severe outbreak of powdery mildew (*Oidium* sp.), probably *Erysiphe polygoni*, occurred on scarlet runner beans [*Phaseolus coccineus*]. Carrots displayed greening of the flowers due to tomato big bud virus. Chinese cabbage at Caringbah was affected by club root (*Plasmodiophora brassicae*) [32, p. 668], a new host record for New South Wales. No. 45 rock-melon was highly resistant to powdery mildew (*E. cichoracearum*) [30, p. 310] at Noumea. Foot rot caused by *F. solani* f. *cucurbitae* [see above, p. 202] occurred on marrow; seed of Triamble pumpkin contained about 2 per cent. infection. Contamination of mushroom spawn by *Bacillus subtilis* caused considerable losses; apparently the bacteria were transferred with the inoculum.

On the northern tablelands no potato crops submitted for certification were

rejected because of excess leaf roll (over 1 per cent. present at the second inspection) [23, pp. 75, 166; 25, p. 62]. Rejection in this area in 1950–1 was 0·4 per cent. of the crops submitted, in the central tablelands 9·9 per cent., and in the southern tablelands 1·5 per cent. Crops at Grafton grown from certified 'seed' had about 2 per cent. leaf roll, whereas a crop of uncertified Sebago had 20 per cent. and one of Mainguy 50 per cent. The hot, dry season favoured scab (*Streptomyces* [*Actinomyces*] *scabies*) [32, p. 234]. Very severe infections occurred in the Orange district, where in the scab resistance trial the susceptible Sebago had an infection severity of about 70 per cent. High resistance was displayed in this trial by a number of imported varieties; some locally bred seedlings showed promise. No New South Wales commercial potato variety is resistant. Katahdin and Sebago were attacked by *Bacterium* [*Pseudomonas*] *solanacearum* [32, p. 668].

In November, 1951, crops of Sebago at Wellington had up to 50 per cent purple top wilt caused by tomato big bud virus [32, p 237] and Sequoia 25 per cent. In one crop of Sebago at Pitt Town, sown in late July, 60 per cent of the plants displayed all stages of infection by December. Infection in the rest of the crops in the vicinity averaged 20 per cent. At Guyra five of ten tomato plants growing near potatoes with about 7 per cent. purple top wilt were affected by tomato big bud virus. A trace amount of purple top wilt has undoubtedly been present in potato crops in New South Wales for many years, but this is the first year that it has caused serious losses. Damage by tomato spotted wilt virus [32, p. 584] was almost negligible in potato crops.

The breakdown of the field resistance of the Grosse tomato variety to *Fusarium* wilt (*F. oxysporum* f. [*F. bulbigenum* var.] *lycopersici*) [31, p. 636] was observed in a higher percentage of crops than before and in soil not waterlogged at any stage. Rouge de Marmande, Red Cloud, and Break o' Day were affected in the Gosford area, in some places on 'new' ground. In the Murrumbidgee Irrigation Areas, where crop rotation is sometimes difficult to adopt, Tatura Dwarf Globe had up to 100 per cent. infection.

Trotman (A. E.). **Annual Report of the Department of Agriculture, Jamaica, for the year ended 31st March, 1951.**—25 pp., 1951.

In this report [cf. *R.A.M.*, 29, p. 459 and next abstract] it is stated that severe damage to tomatoes by late blight [*Phytophthora infestans*: 31, p. 8] necessitated a Government loan of £100,000 to growers in St. Elizabeth.

Coco-nut unknown disease [31, p. 383] continued to spread in the western parishes and many trees were felled in an attempt to localize the disease.

Lime-induced chlorosis [26, p. 335], which affected the cacao propagation nursery severely, was checked by regular spraying with an iron sulphate solution.

An island-wide, sugar-cane disease survey revealed no disease that could be considered as a threat to the industry. Mosaic [sugar-cane mosaic virus: 30, pp. 246, 310] is spread mainly by planting the susceptible variety B.34104. It should be checked by using B.37172, B.3439, B.37161, and other newer varieties, combined with careful roguing.

The incidence of banana leaf spot [*Mycosphaerella musicola*: 30, p. 525 and next abstract] increased at the end of the year owing to the upsetting of the spraying cycle by a heavy storm in September and October. The disease was reduced to normal by careful spraying.

Wright (J.). **Investigations 1950–1951.**—*Bull. Dep. Agric. Jamaica* (N.S.) 49, 153 pp., 1 graph, [? 1952].

In the plant pathology section (pp. 88–89) of this report [cf. *R.A.M.*, 31, p. 8 and preceding abstract] the following are recorded for the first time in Jamaica:

fruit mottle virus on tomato, *Curvularia lunata*, *Glomerella cingulata*, and *Phyllosticta sorghina* on sugar-cane, and *Capnodium* sp. causing sooty mould of rice.

Many cases of coco-nut bud rot (*Phytophthora palmivora*) [24, p. 367] observed on an estate in St. Thomas were due primarily to the failure to treat the first two outbreaks as soon as they appeared. Cacao pod rot (*P. palmivora*) [8, p. 526] and pod anthracnose (*Colletotrichum cradwickii*) [19, p. 664] increased in prevalence in small holdings along the Buff Bay Valley, chiefly owing to wet weather from December to February. Black shank of tomato, often associated with a *Fusarium* sp., continues to cause considerable losses in St. Elizabeth. It generally originates at the collar as the result of mechanical or insect damage sustained either in the seed bed or at transplanting.

In other sections of the report it is stated that the testing of banana plants (p. 91) for resistance to Panama disease (*Fusarium* [*oxysporum* var.] *cubense*) [32, p. 200] is being continued at the Bodles Banana Breeding Station as the Caenwood plot has been abandoned. The seedling variety 1877 (p. 107), the most promising banana produced so far, is being multiplied at the Agricultural Stations for sucker distribution. It appears to be more resistant to leaf spot [*Mycosphaerella musicola*: see preceding abstract] than Lacatan [29, p. 628]; if so considerable sums spent on spraying will be saved.

Studies on Panama disease were made by J. Rishbeth (p. 109). Though Gros Michel suckers could not be infected by direct inoculation, when grown in infested soil the fungus sometimes grew from infected roots into the vascular part of the rhizome [32, p. 634]. As these infections could be counted after a suitable period, the technique was used (*a*) to study the effect on rhizome infection of different amounts of inoculum and various cultural treatments, using one soil type; (*b*) to estimate the natural infective capacity of various soils; and (*c*) to test the pathogenicity of *Fusarium* isolates. Experiments of type (*a*) showed that rhizome infection takes place in both sterilized and unsterilized soil, and could be secured with inoculum equivalent to only one viable spore per gm. soil. Both root and rhizome infection were suppressed when the soil was mixed before inoculation with old bagasse (1 part to 20 parts soil by weight). Type (*b*) experiments indicated that the organism was seldom present in soils not having borne bananas, fallow for several years, or bearing healthy plants. It was fairly abundant in soils where diseased bananas had grown for two years or more. Of the *Fusarium* strains tested so far all those isolated from the rhizome or pseudostem of plants with typical Panama disease symptoms were pathogenic, while nearly all those isolated from soil were not.

The disease developed slowly in two blocks of the earlier fertilizer trials at Holland, but incidence increased considerably after high wind and rain in October, 1950. In three experiments started in 1950 the numbers of plants which developed the disease in nine months at Orange River and Williamsfield (Portland), each having 20 plants per plot, and Caymanas (30) were: given green manure 16·16, 9·9, and 4·4; compost 14·14, 12·7, and 2·2; bagasse 0·1 (at Caymanas); and the [untreated] control 14·13, 9, and 4·2, respectively

At Bodles a new Panama disease testing plot was used for experiments in which the soil was inoculated (*a*) with other soil from the first Panama disease testing plot, (*b*), (*c*), and (*d*) with small, medium, and large amounts, respectively, of finely chopped, infected pseudostem, and in (*e*) an infected sucker was planted alongside. The amount of infection already present was such that only treatments (*a*) and (*d*) gave markedly higher incidence than the control.

An attempt to kill the organism in a small plot at Bodles by flooding to a depth of up to six inches for nine months was unsuccessful [cf. 32, p. 135].

Plantations where Gros Michel plants have been grown continuously for over 20 years with little or no Panama disease always have at least one foot of well-drained and aerated, alkaline, medium to heavy-textured top soil. Available potassium is

moderate to high throughout. In low-lying situations healthy plantations are virtually confined to soils very high in available phosphate and potassium. On the other hand, sites where Panama disease is severe usually have a depleted top soil, a neutral or acid reaction, light texture, low fertility, or poor drainage, or various combinations of these characters.

Administration Report of the Director of Agriculture Trinidad and Tobago for the year 1951.—43+ix pp., 1953.

On p. 21 of this report by C. H. B. Williams [cf. *R.A.M.*, 32, p. 65] it is stated that in Tobago an intensified campaign to eradicate witches' broom of cacao [*Marasmius perniciosus*: 32, p. 305] is being carried out by cutting out infected tissues. It appears that the spread of the cacao virus [31, p. 425] from the northern range of Trinidad to other parts is inevitable. Abnormal rains caused an outbreak of pink disease (*Corticium salmonicolor*) [see below, p. 219] on cacao on two estates. Death of young cacao clones affected by poor drainage was caused by *Calostilbe striispora* [20, p. 453]. The causal organism of witches' broom of the shade tree *Erythrina micropteryx*, occurring in the neighbourhood of Pepper Village, Montserrat, has not yet been identified.

Sugar-cane at the Central Experiment Station exhibited symptoms of chlorotic streak [cf. 32, p. 644]. Experiments to verify the presence of *Xanthomonas rubrilineans* [cf. 32, p. 339] in plants with typical red stripe symptoms are in progress at the Imperial College of Tropical Agriculture. A mild form of sugar-cane mosaic [virus: 30, p. 123] occurs on B.H. 10 (12) and a few older cane varieties in south-west Montserrat but disappears as the cane matures. It is very local and it seems that if a vector is present in Trinidad it does not appear in infected areas, or else modern varieties are resistant to this strain of the virus.

In pot experiments to investigate the epidemic dying of limes [32, p. 65; cf. 33, p. 151], it was found that there was no increased growth of seedlings in soils which had never carried limes, but there was in fumigated infested soils, compared with infested. Growth was adversely affected by alternating wet and dry conditions. An ascending wood necrosis starting from the root tip is present in a high proportion of plants and suggests the presence in 'epidemic' Erin soils of a pathogen which attacks the vascular system at an early stage.

The addition of nitrogen (ammonium sulphate) resulted in a yield increase of 300 per cent. in grapefruit grown on a clay soil at La Réunion Experiment Station. When zinc in conjunction with nitrogen was added, the increase amounted to 330 per cent. Most citrus in Trinidad exhibits deficiency symptoms of magnesium, zinc, and nitrogen [29, p. 291], but the addition of magnesium does not affect the yield.

Heavy losses of coco-nut palms caused by bronze leaf wilt [31, p. 14] occurred in south Trinidad.

Department of Agriculture, Kenya, Annual Report 1951. Vol. I.—53 pp., 1952.

In part II of this report [cf. *R.A.M.*, 33, p. 140], dealing with research and specialist services in Kenya (pp. 19–29), it is stated that strains K9 and K1 of wheat stem rust (*Puccinia graminis*) [33, p. 141] were the most prevalent in 1950; K10 produces the same reactions as K5, except that those on Kenya Governor and Einkorn are reversed. Cross 294, the most popular wheat variety in the Colony, is susceptible to K10, while 318 AJ, second in importance, is resistant to K11. In 1951 serious stem rust attack greatly reduced the crop in Northern Province, Tanganyika. The most important disease of wheat was take-all (*Ophiobolus graminis*) [loc. cit.], increased incidence of which is attributed to a flare-up of existing foci during an exceptionally wet growing season.

Potato and tomato blights (*Phytophthora infestans*) [loc. cit.] were exceptionally

severe throughout the Highlands. Many crops of susceptible potato varieties at higher altitudes were a total loss and few tomato crops grown in the rains gave any return. The widespread attack on perennial wild *Solanum* spp. appears to have produced two new biotypes of the fungus, G and H [see below, p. 250], which have infected all the hitherto immune hybrids obtained from Dr. Black [32, p. 10], though they are still greatly superior in performance to the non-resistant varieties still in cultivation.

During the last three seasons the pyrethrum [*Chrysanthemum cinerariifolium*] bud disease (*Ramularia bellunensis*) [33, p. 140] has averaged slightly under 10 per cent. Because the plant increases its flower production to offset loss of buds through disease, this figure may not result in appreciable economic loss. Contrary to the experience of the previous two years, the disease rate in 1951 was higher east than west of the Rift Valley. There was some indication that spraying with perenox reduced incidence [loc. cit.].

Sisal is affected by four deficiency disorders, 'banding' [29, p. 350], purple leaf tip roll [loc. cit.], leaf tip die-back, and parallel streak. None is yet serious, but experience in Tanganyika indicates that they may become important if sisal continues to be replanted on the same land.

Apples harvested at Molo were severely affected by bitter pit due, it is thought, to excess nitrogen produced by heavy annual dressings of farmyard manure. Symptoms of magnesium deficiency in apples and pears, which vary with the variety but usually include chlorosis or necrosis or both, were corrected by four fortnightly applications of 2 per cent. Epsom salts solution beginning at petal fall.

Annual Report on the Agricultural Department, Nigeria, 1950–51.—123 pp., 4 pl., 1953.

In the section of this report [cf. *R.A.M.*, 30, p. 23] dealing with the work of the Cocoa Division (pp. 103–109) it is stated that in pursuance of the policy of preventing further spread of swollen shoot virus disease [see below, p. 218] by sealing-off affected areas [31, p. 426] the territory round Ibadan has been divided into clearly defined areas; it is now possible to demarcate the approximate limits of the zone (about 497,000 acres) in which cutting-out would at present be ineffective. Part of this area, however, is believed to be less heavily infected than the remainder, and this portion is being re-surveyed in detail. During the first six months after the adoption of the sealing-off policy the general situation had not deteriorated. Within the infected area re-planting is to be carried out, with due precautions. One-third of the area contains soils suitable for rehabilitation with cacao, and if these can be planted with higher-yielding strains under improved standards of maintenance, this, together with plantings in new areas, should go far towards making good the losses sustained through the disease. On marginal soils there is little likelihood of successful rehabilitation with cacao, and other economic crops must be grown, material of which is available in two nurseries.

Further studies on black pod [*Phytophthora palmivora*: 32, p. 476 and below, p. 219] indicate that when the general level of pod yield is low spraying may not be remunerative. Removal of diseased pods gives the best results when carried out every other day. As wind dispersal is an important factor in spread [32, p. 12], the removal of infected pods in a small area adjacent to plantings where no control methods are used may be useless.

Records of disease occurrence.—*Plant Prot. Bull., New Delhi*, 3, 2, pp. 46–48, 1951.

S. K. Bose and P. R. Mehta report on some previously unrecorded disease pathogens in the Kumaun and Garhwal regions of Uttar Pradesh [cf. *R.A.M.*, 32, p. 176], including *Pestalotia sapotae* isolated from mummified fruits of *Achras sapota* and from fasciated branches at Kanpur and Kathgodam, *Phytophthora*

cactorum on apple fruits [cf. 31, p. 244; 33, p. 139], *Claviceps purpurea* [C.M.I. map No. 10] on *Brachypodium sylvaticum*, and *Hymenochaete damaenicornis* on roots of *Dalbergia sissoo* at Kanpur.

M. L. Gattani and R. L. Mathur state that leaf roll or 'Bobri', a virus disease of chillies, is very troublesome in Rajasthan. Affected plants are stunted, the leaves roll, fruiting is retarded, and the fruits remain very small. In 1950–1 the disease caused almost 100 per cent. damage in the Kapasin district. In the Pali district one of the indigenous varieties was highly susceptible but another growing alongside remained free from infection. Selections of the tolerant variety are being tested further.

Plant pathology.—*Rep. N.Y. St. Coll. Agric. Cornell* (combined with *Rep. Cornell agric. Exp. Sta.*), *1951–52*, pp. 54–55, 1952.

In this report [cf. *R.A.M.*, 32, p. 545] it is stated that certain chemicals, used as systemic insecticides, which cannot be applied to table potatoes because of taint, may be used on the soil in small 'seed' plots. Their controlling effect on aphids persists for some time and markedly reduces the spread of leaf roll [32, p. 499]. This disease may eventually be eliminated almost entirely. The leaves of Kennebec and Essex potatoes are highly resistant to blight [*Phytophthora infestans*: 32, p. 543], at least until they have aged, but the tubers are not. Hygrothermographs placed in fields of these varieties informed growers when temperature and moisture favoured the disease [33, p. 142]. In 1951 a satisfactory crop was produced without fungicidal applications.

After several years during which losses from cauliflower bacterial black rot [*Xanthomonas campestris*: 32, p. 656] increased, the disease was eradicated almost completely during 1951 and 1952 by increasing the duration of the hot water seed treatment from 15 to 20 minutes. This appears to kill even the most persistent bacteria.

The plantain strains of tobacco mosaic [virus: 32, p. 283], which have attacked tomatoes in recent years, appear to be spreading gradually and to have caused considerable loss, at least in the Hudson Valley.

Cucumber scab (*Cladosporium* [*cucumerinum*: 33, p. 135]) was not controlled in 1951 by the almost daily application of fungicides. Infection took place at temperatures lower than those at which the chemicals were active.

Agricultural research in Texas, 1950.—71 pp., 56 figs., 1 diag., 1950.

In the plant diseases section (pp. 50–51) of this report [cf. *R.A.M.*, 27, p. 313] are the following items of phytopathological interest. Decay of market onions at College Station was reduced significantly in preliminary tests by spraying with synthetic mustard oil mixed with various non-volatile fungicides such as dithane D-14, dithane Z-78, vancide 51, and mycoban. In other tests a 5 per cent. synthetic mustard oil and 2 per cent. dithane D-14 spray effectively reduced neck rot [*Botrytis* spp.: 30, pp. 113, 211] and other storage diseases during eight weeks at room temperature.

Many strains of Deltapine, Stoneville 2B, and Empire Wilt Resistant cotton resistant to bacterial blight [*Xanthomonas malvacearum*: 32, pp. 374, 624] grown at the Brazos River Valley laboratory and the Greenville station equalled the control plants in most agronomic characters.

Of about 120 soil micro-organisms, mostly actinomycetes, isolated from Blackland soil in 1949 and 1950, 13 were strongly antagonistic to the cotton root rot pathogen, *Phymatotrichum omnivorum* [22, p. 21; 28, p. 287], and 12 slightly less so.

Dithane Z-78 gave the best control of pecan scab [*Cladosporium effusum*: 32, p. 704] on the highly susceptible variety Delmas, the average yield from sprayed trees being 121·8 lb. per tree as against 13·3 lb. from the unsprayed. Intermediate

results were given by fermate 94·2, zerlate 84·3, puratized agricultural spray 76, Bordeaux mixture 54·6, and spergon SL 23·1 lb.

In studies on the reaction of maize lines to several diseases in the nursery one showed considerable resistance to them all, namely brown spot [*Physoderma maydis*], northern leaf blight [*Helminthosporium turcicum*], southern leaf blight and leaf spot [*Cochliobolus heterostrophus*], stalk and ear rots [*Diplodia* and *Gibberella* spp.], smut [*Ustilago maydis*], and rust [*Puccinia sorghi*]. A new ear rot, tentatively ascribed to *Diplodia frumenti* [22, p. 429], is being studied.

Two current approaches to the control of groundnut southern blight [*Sclerotium rolfsii*: 32, p. 300] are a rotation involving winter cover crops and selecting uninfected seedlings from thickly-spaced plants in heavily-infested soil in the field and greenhouse. When seedlings of the least susceptible field-tested lines were heavily inoculated in the greenhouse about 18 plants out of 1,000 survived without apparent injury, these being used for seed production.

The F_2 and F_4 of some new hybrid tomato lines, inoculated to eliminate seedlings susceptible to *Fusarium* wilt [*F. bulbigenum* var. *lycopersici*: 32, pp. 154, 285; 33, p. 16] and the collar rot phase of early blight [*Alternaria solani*: 31, p. 542], have fruits comparing favourably with Rutgers in size, shape, colour, and productivity and are highly resistant to both diseases.

Combes (R.). **Exposé des activités de l'Office de la Recherche Scientifique Outre-mer pour les années 1948–1949–1950.** [Report on the activities of the Office of Overseas Scientific Research for the years 1948–1949–1950.]—71 pp., Paris, [? 1952].

On p. 16 of this publication it is reported that in February, 1949, coffee in the Gagnoa–Oumé–Daloa area of French West Africa was observed to be in a weakened condition owing to defective cultural practices. It appeared that virulent infection by *Fomes lignosus* [*R.A.M.*, 29, p. 99] almost certainly played a large part in the destruction of the trees. By August the situation had worsened considerably as a result of prolonged rains, excessive growth of cover and weeds, and careless clearing, which happened to coincide with a return of sunny, relatively dry weather. The usual methods for the control of foot rots are not applicable in this area, as it is so extensive.

On p. 54 a report from New Caledonia [32, p. 304], where no plant pathological research had been carried out before the recent opening of the special laboratory, states that three aims are being pursued: (1) to make a preliminary list of crop diseases; (2) to demonstrate methods of growing better crops and controlling diseases; and (3) to ensure that the principal fungicides are sold in the local markets. The phytosanitary regulations in force locally have been tightened up and a Consultative Epidemics Committee formed.

Kovoor (A.). **Action stimulante de quelques extraits de fruits et de graines sur le développement des tissus de crown-gall de Scorsonère, cultivés in vitro.** [Stimulatory action of some fruit and seed extracts on the development of *Scorzonera* crown gall tissues cultured *in vitro*.]—*C. R. Acad. Sci., Paris*, 237, 3, pp. 271–272, 1 graph, 1953.

A stimulatory action was exerted on tissue cultures of *Scorzonera* crown gall [*Bacterium tumefaciens*: *R.A.M.*, 33, p. 19] by extracts of the fruits and seeds of the jak tree, *Annona muricata*, passion fruit (all at 5 per cent.), and *Allanblackia floribunda* (5 and 50).

Garber (E. D.) & Hackett (Adeline J.). **Virulence of auxotrophic mutants of Erwinia aroideae.**—*Nature, Lond.*, 173, 4393, p. 88, 1953.

In co-operative experiments between the Department of Botany, University of

Chicago, and the Division of Genetics, University of California, two auxotrophic mutants of *Erwinia aroideae* [*R.A.M.*, 33, p. 73], threonine- and tryptophane-requiring, were isolated after ultra-violet irradiation from a potato tuber which developed a distinctive brown discoloration with the parent strain and eventually rotted. The threonine-requiring mutant produced the typical discoloration but less markedly than the parent strain. The tryptophane-requiring mutant, however, produced no discoloration until a few drops of tryptophane solution were scattered on a sliced, inoculated tuber. Two mutants which had reverted to prototrophy regained their virulence simultaneously with the loss of the requirement for tryptophane. The sustained virulence of the threonine-requiring mutant suggests that the surface of the tuber contains the substance required.

These preliminary results suggest a potential method of bioassay using auxotrophic mutants of pathogens having distinctive pathological reactions in the host to detect the presence or absence of specific substances.

Annual Report West African Cacao Research Institute. April, 1950 to March, 1951. —63 pp., 1953; **April, 1951 to March, 1952.**—54 pp., 1953. 5*s.* each.

In the virus research section (pp. 7–15) of the 1950–1 report [cf. *R.A.M.*, 31, p. 231] it is stated that two new strains of cacao swollen shoot virus [31, p. 427 and above, p. 215] were found. At Saalman in the Akim Abuakwa district, Gold Coast, the leaf symptoms of one strain were confined to one half of the leaf and appeared as a yellow mottle covering almost all that half and tending to form a false sickle-leaf. The other strain was found at Tepa, Ashanti, in an outbreak affecting only 30 to 40 trees, 40 miles from any other known outbreak. The virus was confined to the leaves, the young flushes displaying a red mottle between the lateral veins, and the mature leaves a flecking of the tertiary veins. The symptoms often affected one half of the lamina only.

Whereas in August, 1945, only 31 per cent. of the trees on the 8½ acre experimental plot were affected by virus 1A [31, p. 427], by March, 1951, the figure had risen to 92·2 per cent., the yield decreasing during the same period from 8·75 to 1·2 loads per acre.

In the experiment to determine whether infection of trees with a mild strain of 1A renders them immune from subsequent attack by a virulent strain of the same complex [31, p. 231] the number of controls showing virulent infection greatly increased, though the spread of virulent virus infection into plots given prior infection with mild virus was retarded. Transmission of the virulent virus from trees previously infected with mild virus was obtained when only one vector was used as the transmitting agent. In 1951–2 the virulent strain was obtained more frequently than the mild.

In tests of the host range of the cacao viruses [loc. cit.; 31, p. 232] it was proved that *Corchorus tridens* is susceptible to virus 1A and was killed by it, though it did not appear to be infected by other strains. *Pterygota macrocarpa* also was susceptible to virus 1A only.

In the section on mycology (pp. 37–40) it is reported that as in previous years, while incidence of pod diseases, particularly black pod (*Phytophthora palmivora*) [see next abstract and above, p. 215], was reduced by fungicidal spraying, no treatment affected the mean weight of wet beans per pod, though the total harvests from the control and Bordeaux-treated plots were significantly lower than those from plots given other treatments. In the controls cankered cushions were much more numerous than in the other plots, and were non-productive. In the Bordeaux plots loss of crop appeared to be due to poor set resulting from the burning of the blossoms by the spray. Considerable control of primary infection was given by perenox (mean per cent. of black pod 6·8) and Bordeaux (8·13); D.D.T., weekly harvesting, and control plots had, respectively, 10·78, 12·25, and 13·94 per cent.

In the second report (virus research section pp. 7–8) it is stated that a new strain of cacao swollen shoot virus was collected from the Wenchi–Techiman area of Ashanti; it displayed symptoms resembling those of Bosomuosu 2 (Western Province); another from Okerikrom–Dormaa (Ashanti) produced a light green mottle along the primary and secondary veins with swellings on the chupons.

Tests with the severe strain of virus 1A on *Triplochiton scleroxylon*, *Cistanthera papaverifera* *Desplatzia lutea*, *Cola nitida*, *Hibiscus esculentus*, *Gossypium* spp., and *Xanthosoma* spp. were again negative, as were first tests on cassava, *Abutilon asiaticum*, *Datura stramonium*, *Ricinodendron africanum*, chilli (*Capsicum annuum*), and a wide range of forest trees, some with virus-like symptoms. *Corchorus tridens* is frequently infected but symptomless. Two *Bombax buonopozense* seedlings experimentally infected in 1948 with the Offa Igbo strain [29, p. 608] of swollen shoot virus have, since March, 1951, given positive results when tested at intervals of two months. All previous attempts had failed, in spite of repeated coppicing. The symptoms expressed in the cacao test plants became more intense at each subsequent back-test.

In the section on mycology (pp. 27–28) it is stated that records of pod disease investigations show that about 10 per cent. of the potential cacao harvest has to be discarded, rather more than half this loss being due to damage by *P. palmivora*. Rodent injury can account for 25 per cent. and other factors for approximately 2½ per cent.

In the section on arboricides (pp. 32–36) experimental results are reported, demonstrating that cacao trees can be killed with certain chemicals either by treating the standing tree or by stump treatment after felling. For forest trees formulations of the *n*-butyl and isopropyl esters of 2,4-D and 2,4,5-T in a number of instances have given a kill. Further treatments are progressing.

Thorold (C. A.). **Observations on fungicide control of witches' broom, black pod and pink disease of Theobroma cacao.**—*Ann. appl. Biol.*, 40, 2, pp. 362–376, 1953.

In spraying tests carried out on two estates in Trinidad between 1940 and 1946 against cacao witches' broom (*Marasmius perniciosus*) [*R.A.M.*, 32, p. 305] monthly applications of 1 per cent. Bordeaux mixture [27, p. 223; 31, p. 545] gave 17·53 brooms per tree (mean), as against 40·05 for the unsprayed. Cushion brooms were not reduced and on clone ICS 4 spraying was associated with an increase in cushion brooms. No advantage appeared to accrue when the interval between the spray applications was reduced to one or two weeks, vegetative brooms continuing to develop.

Following fortnightly applications of 1 per cent. Bordeaux mixture or 0·2 per cent. perenox the mean numbers of shoots affected by pink disease (*Corticium salmonicolor*) [26, p. 188] were, respectively, none and 0·25 per tree, as compared with 1·38 for the unsprayed. On the Bordeaux-treated plots the disease recurred 14 months after spraying and on the perenox-treated plots after three and five months.

In experiments carried out in Nigeria satisfactory control of black pod (*Phytophthora palmivora*) [31, p. 232; 32, p. 12, and preceding abstract] followed the use of carbide Bordeaux, prepared by adding solid calcium carbide to 1 per cent. copper sulphate solution, and applied at intervals of one to four weeks. Only the developing fruit was sprayed. The mean numbers of black pods per tree for 1, 2, 3, and 4 weeks' intervals between the applications were 0·9, 0·3, 0·6, and 0·7, with 9·5 for the unsprayed in 1950–1, and 0·6, 0·2, 0·2, 0·4, and 6·3 in 1951–2. The corresponding figures for the mean numbers of healthy pods per tree were 14·3, 8·4, 15·7, 7·4, and 16·3 in 1950–1, and 10·8, 7·2, 6·8, 6·1 and 10·8 in 1951–2. Perenox (0·1 per cent.) was less effective. Knapsack spraying did not protect pods more than 7 feet from the ground.

In Fernando Po two to four applications of Bordeaux mixture are made every season on almost every estate, and consequently there are relatively few sources of black pod infection.

Batts (C. C. V.). **Testing crop varieties for disease resistance—the work of the Mycology Department at the N.I.A.B.**—*J. nat. Inst. agric. Bot.*, 6, 3, pp. 341–345, 1953.

An account is given of the work started in 1950 in the mycology department of the National Institute of Agricultural Botany, Cambridge, on the development of suitable methods for testing the resistance of new and established varieties of crops to diseases of economic importance. The method of testing resistance to yellow rust (*Puccinia glumarum*) of wheat [*R.A.M.*, 32, p. 617 and above, p. 204] and barley [29, p. 609] consists in inoculating plants of each variety with each race of the fungus in the greenhouse from about the end of February to the end of May, and again in September, October, and November, and in examining as many trials as possible each year, assessing the amount of infection present on each variety. Races, including any new race or biotype present on collected samples, are identified. For testing resistance to loose smut of wheat [*Ustilago tritici*: 32, p. 74] and barley (*U. nuda*) [loc. cit.] the partial vacuum method [18, p. 792; 32, p. 173] has proved very satisfactory.

Vallega (J.), Cenoz (H.), Tessi (J. L.), & Frecha (J. H.). **Observaciones realizadas durante el año 1952 en el Registro Epifitiológico y en el Ensayo Territorial de resistencia a las enfermedades de los cereales.** [Observations made during the year 1952 on the epiphytological chart and in the field assay of resistance to cereal diseases.]—*Hoja Inst. Fitotécn., B. Aires*, 14, 21 pp., 7 maps, 1953. [Mimeographed.]

Included in this fully tabulated statistical survey of diseases affecting cereal crops in Argentina [cf. *R.A.M.*, 30, p. 515] during 1952 is the following information. Resistance to black rust (*Puccinia graminis*) [see next abstract], which was, in general, of only moderate intensity, was shown by the wheat varieties Kenya 338 D(ivision) I(mmunología) V(egetal) 5450, Frontana (D.I.V. 420), and Kenya 58 (D.I.V. 244). The physiologic races present were 17, 11, and 15 (all Arg.) [32, p. 73].

The incidence of brown rust of wheat (*P. rubigo-vera tritici*) [*P. triticina*: 31, p. 10] was subnormal. Important sources of resistance were found in the varieties Tremez molle (D.I.V. 5629) and Klein Titan (D.I.V. 396). The physiologic races encountered were 20, 15, and 77 (all Arg.); race 20 was subdivided into five biotypes and 15 into two on the basis of the symptoms they induced on some supplementary differential varieties.

Yellow rust (*P. glumarum*) was widespread in a very mild form. Chino 166 × Lin Calel (D.I.V. 156) remained free from infection in all the tests [cf. 30, p. 514], while Frontana (D.I.V. 420), Capelli (D.I.V. 4786), Dickson's 444 (D.I.V. 5630), and Kenya 338 (D.I.V. 5450) developed only traces.

The only commercial wheat varieties with any degree of resistance to *Septoria tritici* [loc. cit.] were Candeal sel. La Previsión and Klein 157.

By means of a new set of differential varieties, race 1 of crown rust of oats (*P. coronata*) was subdivided into five Argentine biotypes, namely, 237, 226, and 227, Nueva Urug., and Nueva S.Fé, while a biotype of race 45 Arg. was identified as Nueva S.Fé-Bond. The races of *P. g. avenae* encountered on oats were 4 Arg. and 7 Arg. [29, p. 353].

Attacks of *P. anomala* [*P. hordei*] on barley [14, p. 27] were widespread but not generally severe, though an incidence of 80 per cent. was recorded in one area.

The only physiologic race observed was 14 Arg. *Helminthosporium teres* [30, p. 515] was prevalent and destructive in two districts. *Rhynchosporium secalis* [loc. cit.] assumed extraordinary virulence in all field experiments, even on varieties hitherto regarded as resistant, suggesting the development of new physiologic races. The most resistant selections were RM 85, D.I.V. 2383, and Primor × Trebi, with averages of 3, 5, and 1·6 per cent. infection, respectively, and a maximum of 10 per cent.

Flax rust (*Melampsora lini*) [31, p. 433] was almost ubiquitous but caused little damage, while *S*[*phaerella*] *linicola* [*Mycosphaerella linorum*] was both infrequent and unimportant.

Consejos de siembra de Trigo para el año 1953. Mapa de la región triguera. [Recommendations for the sowing of Wheat in the year 1953. Map of the Wheat-growing region.]—*Publ. misc. Minist. Agric., B. Aires*, 369, 14 pp., 1 map, 1953.

The reactions to *Puccinia graminis* of the 19 wheat varieties recommended for planting in 1953 in the wheat-growing provinces of Argentina [*R.A.M.*, 32, p. 73 and preceding abstract] are noted. Growers are advised to disinfect seed before sowing against bunt (*Tilletia* spp.), a national 'pest' under Statute 4863 [loc. cit.; 33, p. 12].

Patel (M. K.). **Relation between amount of initial inoculum and severity of Wheat stem rust outbreak in peninsular India.**—*Plant Prot. Bull., New Delhi*, 3, 2, pp. 49–51, 1951.

The author reviews the conditions necessary for an epidemic outbreak of wheat stem rust [*Puccinia graminis*] in India [*R.A.M.*, 33, p. 145] and discusses plans for preventing such outbreaks [see next abstract].

Mehta (P. R.), Prasad (N.), Gattani (M. L.), Mathur (R. L.), Nikam (B. G.), Asthana (R. P.), Chowdhury (S.), Dubey (J. K.), & Mishra (J. N.). **Wheat rust situation in various States of India during 1950–51.**—*Plant Prot. Bull., New Delhi*, 3, 2, pp. 43–45, 1951.

This is a brief account of the wheat rust situation in various parts of India in the 1950–1 season. Infection by black rust (*Puccinia graminis tritici*) [see preceding abstract] was very slight in many places, though at Bhopal a small plot of the A.O. 13 variety on waterlogged soil was heavily infected late in January. In the Sri Ganganagar district of Rajasthan yellow rust [*P. glumarum*: *R.A.M.*, 33, p. 145] was fairly severe on the C591 and Punjab 8 varieties. Severe attacks of yellow and brown rust [*P. triticina*: loc. cit.] were observed in February on wheat grown near rivers and dams in Madhya Bharat.

Watson (I. A.) & Singh (D.). **The future for rust resistant Wheat in Australia.**—*J. Aust. Inst. agric. Sci.*, 18, 4, pp. 190–197, 1 diag., 1952.

After pointing out that Australian wheat varieties resistant to stem rust [*Puccinia graminis*: *R.A.M.*, 31, p. 109] soon become susceptible in the field, the authors discuss (with regard also to *P. triticina*) the fate of such varieties, which are attacked by new rust races, the relation between old and new races, the significance of commercial rust-resistant varieties in the composition of the rust flora, varieties at present resistant, future varieties, mutations in relation to combined resistance, and the detection of new types of rust [28, p. 450; 32, p. 617]. In breeding resistant varieties all aspects of variability in the pathogen should be studied, including the production of new, more virulent forms by artificial means and hybridization on the alternate host. The first need in Australia is a determination of the rust races on a set of resgenes selected locally; the same set would probably be useful throughout

the country. Valuable data would also accrue from using genes of future varieties among the differential set. Kenya 117A 1347 [cf. 29, p. 150], for example, will probably be a parent of new varieties; by exposing it to collections from widely separated areas more would become known of the limits of its resistance.

It is concluded that the changes observed in the Australian rust flora during the last ten years are probably due to mutations. The new races appear to have extended their pathogenicity range one step at a time, each step involving one new gene in the host. There is as yet no evidence of a change involving two host genes simultaneously. Accordingly the present breeding programme of the University of Sydney involves the incorporation of pairs of genes for resistance into a basic genotype well adapted to local conditions. When these derived types are evolved they will, it is expected, remain resistant in the field for longer periods than similar types with single resistances.

MEAGHER (J. W.). **Bunt or stinking smut of Wheat. Progress report on seed dusting trials with hexachlorbenzene (H.C.B.).**—*J. Dep. Agric. Vict.*, 51, 11, pp. 502–504, 1 fig., 1953.

The results of trials conducted in the 1949–50 and 1952–3 seasons at Longerenong Agricultural College, Victoria, Australia, demonstrated that seed treatment with hexachlorobenzene [*R.A.M.*, 32, p. 549], at not less than 10 per cent. concentration and 2 oz. per bush. or 20 per cent. at 1 oz. per bush., gave better control of wheat bunt [*Tilletia caries* and *T. foetida*: 31, p. 597 and next abstract] than copper carbonate, U.T. 11001, or the liquid mercurical M.M.D.D. (methyl mercury dicyandiamide) and was at least as effective as the standard mercurial dust (ethyl mercuric chloride). The percentage bunt sustained in 1951 from inoculated copper carbonate-treated Javelin seed was 1·04, from U.T. 11001, 0·14, 10 and 15 per cent. brand A HCB 0·02 and 0·01, and ethyl mercuric chloride 0·04, compared with 69·5 for the untreated. All treatments were at 2 oz. per bush. The average percentages of bunt in the 1952–3 experiments were: 10 and 15 per cent. commercial HCB (at 2 oz. per bush.) 0·39 and 0·35, 25 per cent. HCB (1 oz.) 0·31, copper carbonate (2 oz.) 7·18, ethyl mercuric chloride (2 oz.) 0·37, 0·8 per cent. M.M.D.D. (56 ml.) 1·17, ethyl mercuric phosphate (2 oz.) 0·09, and the untreated 82·4. Further trials are in progress.

GODINO (I.). **Considerazioni su alcuni anticrittogamici organici acuprici con particolare riferimento alla lotta anticarie.** [Considerations on some non-copper organic fungicides, with special reference to bunt control.]—*Notiz. Malatt. Piante*, 22 (N.S. 1, *1953*), pp. 35–44, 1953.

In this paper, read before the first meeting of the Società italiana di Fitoiatria, held at Milan on 28th February and 1st March, 1953, the author, after succinctly tracing the early history of the control of wheat bunt (*Tilletia*) [*T.* spp.] in France and Italy by seed treatment with materials containing copper [*R.A.M.*, 11, p. 442; 31, p. 484, *et passim*], summarizes and discusses the results obtained recently in France with non-copper organic fungicides [loc. cit.; cf. 32, p. 550], especially hexachlorobenzene [loc. cit.; 26, p. 150; 31, p. 110, and preceding abstract].

GASSNER (G. C.). **Untersuchungen über Keimungsbedingungen und Bekämpfungsmöglichkeiten beim Zwergsteinbrand (Tilletia brevifaciens) im Laboratorium.** [Studies on the conditions for germination and possibilities of control of dwarf bunt (*Tilletia brevifaciens*) in the laboratory.]—*Phytopath. Z.*, 21, 1, pp. 53–62, 1953.

In the author's studies at the Plant Protection Research Division of the Hoechst Dye Works, using collections of wheat bunt (*Tilletia brevifaciens*) [see above, p.

205 and following abstracts] from Ingolstadt and Bayreuth, Germany, germination was found to depend on light, temperature, and oxygen. Suitable illumination was provided by daylight and continuous light from a mercury vapour lamp with a luminous covering; no germination occurred in darkness. In daylight satisfactory germination took place at temperatures between 5° and 14° C., and under continuous artificial light in a refrigerator at 5°. The addition to each dish containing emulsified clay soil of a drop of potassium permanganate solution at concentrations ranging from 2·5 to 10 per cent. uniformly stimulated spore germination, and there are reasons to believe that the green soil flora (mosses and algae) activated by light would likewise serve as good sources of oxygen. In daylight germination began after about a month and reached a maximum from the sixth to the eighth week, the corresponding periods for artificial illumination being three weeks and the fourth to fifth week.

The efficiency of anti-bunt specifics may be tested by pressing inoculated, treated seeds into the clay soil emulsion to a depth of 2 to 3 mm. and keeping the dishes under appropriate conditions of light and temperature. In these experiments tritisan [*R.A.M.*, 32, p. 308] suppressed germination at dosages of 150 and 200 gm. per kg. Soil disinfectants should be dusted on to a spore smear under a bell jar; in tests with brassicol [loc. cit.] germination was inhibited at concentrations equivalent to 25 and 50 kg. per ha.

Pichler (F.). **Zur Frage der Keimung von Roggen- und Zwergsteinbrandsporen. Vorläufige Mitteilung.** [On the question of the germination of Rye and dwarf bunt spores. Preliminary Report.]—*PflSchBer.*, 11, 1–2, pp. 12–17, 1953. [English summary.]

At the Institute for Plant Protection, Vienna, the spores of rye bunt [*Tilletia secalis*: *R.A.M.*, 30, p. 408] and of dwarf bunt [of wheat: *T. brevifaciens*: see preceding and next abstracts] germinated up to 100 per cent. on a medium of loam soil mixed with a 1 per cent. solution of liquid stable manure in dishes exposed to the light at a temperature of 6° C., those of *T. secalis* in three to four weeks, and *T. brevifaciens* in four to six.

Böning (K.), Wagner (F.), & Minckwitz (Astrid v.). **Untersuchungen zur Keimungsbiologie und Beizung der Sporen des Zwergbrandes an Weizen.** [Studies on the biology of germination and on spore disinfection of dwarf bunt of Wheat.]—*Z. PflBau*, 4 (48), 2, pp. 49–71, 1 fig., 1 diag., 1953.

The results of studies at the Bavarian Institute for Agricultural and Plant Protection on the conditions governing spore germination of *Tilletia brevifaciens* [see preceding and next abstracts] are described and tabulated. Unlike *T. tritici* [*T. caries*], *T. brevifaciens* did not germinate in liquid media and could not be induced to do so by the addition of various stimulants. On smears of ordinary field soil, however, it germinated and produced mycelium and (very scantily and tardily) secondary sporidia. In general, the spores of *T. brevifaciens* require a protracted resting period in the soil before germination, which even then tends to be very irregular in contrast to the rapidity and completeness of the process in *T. caries* [*R.A.M.*, 30, p. 30; 33, p. 146]. In these experiments the optimum temperature for spore germination in *T. brevifaciens* ranged from 2° to 8° C., while above 12° barely a trace occurred. Light was essential to germination. The persistence of the spores in the soil for two years was demonstrated with certainty, and a three-year period of survival is regarded as highly probable. Promising results were obtained in preliminary seed disinfection experiments, but no verdict as to the relative merits of the various preparations tested can yet be pronounced. The need for the recognition of seed contamination by *T. brevifaciens* is emphasized in connexion with the certification rules.

Böning (K.) & Wagner (F.). **Was kann nach dem derzeitigen Stand der Forschung gegen den Zwergbrand des Weizens unternommen werden?** [What can be undertaken for Wheat dwarf bunt control at the present stage of research?] — *Pflanzenschutz*, 5, 9, pp. 121–122, 1953.

In the light of experience gained up to the present [at the Bavarian Institute for Agriculture and Plant Protection], two methods may be used for the elimination of dwarf bunt of wheat [*Tilletia brevifaciens*: see preceding and next abstracts] in the soil. Dusting with brassicol-super (a new brand of brassicol containing different adjuvants, supplied by Farbwerke Hoechst), at dosages of 75 to 100 kg. per ha. on breeding or propagation sites and 50 kg. elsewhere should be carried out within a fortnight to three weeks after sowing. The cost of the fungicide is DM. 1·20 per kg. for 50 kg. and DM. 1·30 for smaller quantities. In one year's experiments spraying the soil with 3 per cent. copper sulphate (800 to 1,000 l. per ha.) gave satisfactory results, but this method is at least as expensive as dusting and appears, in general, to present no special advantages. In either case seed treatment with one of the authorized preparations remains indispensable.

Röder (K.). **Über eine Infektionsmethode und die Bekämpfung des Weizen-Zwergsteinbrandes (Tilletia tritici nanifica = Tilletia brevifaciens). (Vorläufige Mitteilung).** [On a method of infection and the control of Wheat dwarf bunt (*Tilletia tritici nanifica = Tilletia brevifaciens*). (Preliminary note).]— *NachrBl. dtsch. PflSchDienst (Braunschw.), Stuttgart*, 5, 9, pp. 140–141, 1953.

The following method of inoculation with *Tilletia brevifaciens* [see preceding and next abstracts] was used in preliminary tests on the control of the disease at the Plant Protection Experiment Station of Schering A.G., West Berlin. After sowing in autumn the soil was inoculated by means of a small hand spray with a spore suspension (1 gm. spores per linear m.). At harvest time the incidence of infection in rows sown with untreated seed and that treated with mercurials or mercury-free dressings ranged from 30 to 68 per cent.

In combined seed and soil disinfection tests the soil was sprayed a week after sowing and at subsequent intervals with a fungicidal mixture at 1,000 l. per ha. The best results (0 per cent. infection) were obtained with a combination of an [unspecified] organic mercury seed dressing and an [unnamed] chlorinated hydrocarbon, the former at the rate of 200 gm. per 100 kg. and the latter at 0·3 or 0·5 per cent. The maximum incidence of infection (2·6 per cent.) occurred in the rows treated with 100 gm. seed dressing and 0·06 per cent. spray mixture.

Holton (C. S.). **Pathogenicity studies with inbred lines of physiologic races of Tilletia caries.**—*Phytopathology*, 43, 7, pp. 398–400, 1953.

This is a tabulated survey of further studies at Washington Agricultural Experiment Station, Pullman, on the pathogenicity of 48 inbred lines of physiologic races of *Tilletia caries* obtained from inoculations with paired monosporidial lines [*R.A.M.*, 33, p. 146]. The test wheat varieties were the same as those used previously [25, p. 209] except that Orin (Orfed × Elgin-3) was substituted for Oro and Sarheim (Hussar × Hohenheimer, C.I. 10068–1) was added to the assortment.

The original differentiation of races T-9 and T-10 was based on their intermediate and high virulence, respectively, on Hohenheimer [15, p. 287; 17, p. 164], but this criterion is no longer applicable since both were about equally pathogenic in the present series of tests. T-9 appears to be heterozygous for pathogenicity, whereas T-10 inbreds behaved similarly to the presumably homozygous parent, apart from a few anomalies requiring further elucidation.

Races T-15 and T-12 also represent wide ranges in pathogenicity; tests showed that T-15 must be regarded as homozygous and T-12 as heterozygous for pathogenicity.

T-4 and T-6 were separated in the first place by a difference in degree of virulence on Albit [loc. cit.], which has become less marked. Both races are apparently heterozygous for pathogenicity. T-8 is also heterozygous but a general diminution of virulence, especially on Martin, occurred in all the five lines descended from one spore of this race.

The theoretical and practical implications of these findings are briefly discussed.

Konzak (C. F.). **Inheritance of resistance in Barley to physiologic races of Ustilago nuda.**—*Phytopathology*, 43, 7, pp. 369–375, 1953.

Evidence is presented from the Department of Plant Breeding, Cornell University, Ithaca, New York, that resistance in barley to loose smut (*Ustilago nuda*) may be inherited differently according to the physiologic race of the fungus and the host variety involved [cf. *R.A.M.*, 32, p. 247; 33, p. 148 and next abstract]. Thus, resistance to race 1 was found to be determined by a single dominant gene residing in each of the varieties Jet and Valki, both of which, moreover, carried two genes for resistance to races 3 and 7. Both Valki genes were necessary to confer resistance, whereas either of the Jet ones would suffice. Resistance to races 4 and 8 was governed by either of the two independent genes present in each of the resistant varieties. Jet possesses a single factor for resistance to race 6 and Valki two. The results of studies on races 2 and 5 were inconclusive on account of the limited populations observed.

The viability of seeds inoculated with races 1 and 6 was not associated with inherent resistance or susceptibility to *U. nuda* [cf. 30, p. 461]. There was no indication of linkage between the genes for resistance to races 1, 3, or 6 and four morphological characters. No symbols were allotted to the resistance genes pending an elucidation of their interrelationships.

Tapke (V. F.). **Longevity in Ustilago nuda. Physiologic races in Ustilago nuda.**—Abs. in *Phytopathology*, 43, 7, p. 407, 1953.

Stored at room temperature, the chlamydospores of *Ustilago nuda* normally retain high viability [cf. *R.A.M.*, 32, p. 549] for a few months only, a serious obstacle to progress in the study of physiologic races [see preceding abstract]. It was found, however [at the Plant Industry Station, Beltsville, Maryland], that after storage at 28° to 32° F. numerous one- to ten-year-old collections germinated well, while the percentages of viability of a 13- and a 14-year-old collection were 14 and 12 per cent., respectively. Spores of the latter were used to inoculate flowers of Alpha (C.I. 959) barley, which produced smutted seeds. Grain from barley flowers inoculated with highly viable collections of *U. nuda* and stored at 28° to 32° for seven years gave rise to plants with up to 73 per cent. infected heads.

The results of studies to date confirmed the known difficulty of finding barley varieties for the differentiation of physiologic races, only three having been selected in the course of tests involving 57 spring types, namely, Charlottetown (C.I. 2732), Compana (C.I. 5438), and Valki (C.I. 5748), with the possible addition of Stephan (C.I. 8051), which resembles Compana. Tests on these varieties with 123 collections of loose smut from 31 States resulted in the separation of five distinct races. One widespread race, particularly prevalent in the north, was represented in 60 per cent. of the collections, while another, common in the south, occurred in 26 per cent.; the other three were found in only 14 per cent. of the material.

Leben (C.), Arny (D. C.), & Keitt (G. W.). **Small grain seed treatment with antibiotic helixin B.**—*Phytopathology*, 43, 7, pp. 391–394, 1 fig., 1953.

In small-scale greenhouse and field tests at the Wisconsin Agricultural Experiment Station seed treatment with a semi-purified preparation of helixin B [*R.A.M.*, 32, p. 394] in a solvent was generally effective in controlling *Helminthosporium*

victoriae on Vicland oats and *H. sativum* on Wisconsin Barbless barley, comparing favourably in most cases with ceresan M [32, p. 549]. In a few field tests the antibiotic also gave satisfactory control of wheat bunt (*Tilletia foetida*), loose and covered smuts of oats (*Ustilago avenae* and *U. kolleri*), and barley loose smut (*U. nuda*).

In 18 *in vitro* experiments the germination of *Glomerella cingulata* spores was inhibited or significantly retarded by four preparations of helixin B acting across an air space.

HOPPE (P. E.). **Hormodendrum kernel rot in dent Corn.**—*Phytopathology*, 43, 7, p. 386, 1 fig., 1953.

An exceptionally high incidence of rot following injury to the kernels was observed in a field of hybrid maize in Wisconsin in 1952, some 5 per cent. of the ears and from under 1 to 25 per cent. of the kernels in different ears being affected. A species of *Hormodendrum* [*R.A.M.*, 29, p. 555], unaccompanied by any of the commoner wound parasites, was consistently isolated from the diseased material. The wounds consisted of breaks, apparently of genetic origin, in the pericarp, usually in the centre of the crown, and the damage ranged from a superficial darkening along the margins to quasi-complete decay of the kernel. Severe infection was characterized by blackening of the entire crown, which presented a charred appearance.

MENDES (O.). **Recomendações sobre prevenção e combate a doenças encontradas em culturas de Milho e Tabaco. Ferrugem do Milho.** [Recommendations for the prevention and control of diseases encountered in Maize and Tobacco plantings. Maize rust.]—*Gaz. Agric. Moçamb.*, 5, 50, p. 202, 1953.

Puccinia polysora, recently observed for the first time on maize crops in the Chimoio, Manica, and Búzi regions of Mozambique, is believed to have been introduced into the country from Southern Rhodesia, whence it was reported (and also from Nyasaland) early in the current year [cf. *R.A.M.*, 33, p. 150; C.M.I. map No. 237]. Late sowing appears to be the most satisfactory method of obviating the losses caused by the rust.

SHERBAKOFF (C. D.). **Fusaria associated with Citrus feeder roots in Florida.**—*Phytopathology*, 43, 7, pp. 395–397, 1 fig., 1953.

Fusarium and *Penicillum* spp. predominated among the isolates obtained at the University of Florida, Gainesville, during a six-month period beginning on 1st February, 1952, from the feeder roots of citrus trees suffering from spreading decline in Florida [*R.A.M.*, 33, p. 25]. The *Fusarium* species were identified as *F. semitectum*, *F. equiseti*, *F. solani* and its var. *martii*, *F. oxysporum*, *F. bulbigenum*, and *F. bulbigenum* f. 1. n.f. The association of all except *F. semitectum* with the feeder roots was frequent but appeared to be significant only with *F. bulbigenum* f. 1. The dimensions of its three-, four-, and five-septate macroconidia were 33 to 41 by 3·7 to 4·1 (mean 38 by 3·9) μ, 38 to 44 by 3·7 to 4·2 (42 by 4) μ, and 40 to 58 by 3·7 to 4·3 (47 by 4·1) μ, respectively. The nature of the connexion between the species under observation and the citrus feeder roots is not yet clear. The fungi are probably concerned in some way with the life of the host, though there is no evidence of direct pathogenicity or relation to spreading decline.

Dr Klotz returns after study of Citrus problems in Europe.—*Calif. Citrogr.*, 38, 12, pp. 448–449, 1953.

A tour of the Mediterranean citrus-growing regions during 1953 revealed that the main diseases in Spain were scaly bark [? psorosis: C.M.I. map No. 65], particularly

on Washington navel oranges, brown fruit rot and occasional gummosis [*Phytophthora* spp.: Nos. 35, 47], heartwood rot of old trees by various fungi, and zinc [*R.A.M.*, 32, p. 184], iron, manganese, and magnesium deficiency. In Sicily mal secco [*Deuterophoma tracheiphila*: 32, pp. 125, 250 and next abstract] was found in all parts of the tree, even the heartwood, and affected the fruit at all stages of maturity. The use of rootstocks such as *Citrus volkameriana* and lemon selections which have remained free from the disease for 3½ years may be useful. Other diseases in Italy were brown rot and gummosis, blast and black pit [*Pseudomonas syringae*: 31, p. 183], which were particularly severe during the spring, scaly bark, and zinc, manganese, magnesium, iron, and possibly boron deficiency.

The principal troubles in Morocco were several virus diseases of the scaly bark complex [31, p. 432], stubborn disease [30, p. 104], and nutritional deficiencies [27, p. 319].

Klotz (L. J.). **Mal secco and other diseases of Citrus in Italy.**—*Calif. Citrogr.*, 39, 1, pp. 3, 20, 22–23, 1953.

The author's recent visit to Italy yielded the following information concerning citrus mal secco (*Deuterophoma tracheiphila*) [see preceding abstract]. Dr. Scriviani, working at the Montecatini laboratories, near Florence, detects the disease in the earliest stages by applying 95 per cent. alcohol and 10 per cent. ammonia to the exposed cambium of a suspected twig [cf. *R.A.M.*, 33, p. 150]; it turns yellowish brown if diseased. Cleopatra mandarins are highly resistant to mal secco [31, p. 63]. Primary infections occur chiefly between November and February, mostly in January, and the symptoms appear three to six months later. Rain favours the disease by aiding spore development and dissemination.

Spore germination was prevented by the following: 1–1–100 Bordeaux mixture; 5–1–4–100 zinc-copper-lime; ½ lb. captan, zineb, or hyamine per 100 gals.; 2½ per cent. ferrous sulphate solution; and 1–6400 copper sulphate, but most of the materials tested were ineffective when added to soil containing slivers of infected citrus wood, from which the pathogen was always reisolated. Malachite green (100 p.p.m.) pressure-injected into the wood of diseased trees at 200 lb. per sq. in. caused no apparent injury and appeared to kill the fungus, but the treatment should take place during dormancy or the trees will split.

Knorr (L. C.). **Transmission trials with crinkle-scurf of Citrus.**—*Plant Dis. Reptr*, 37, 10, pp. 503–507, 3 figs., 1953. [Multilithed.]

Crinkle-scurf, a previously undescribed disorder of citrus causing crinkling of the leaves [cf. *R.A.M.*, 33, p. 72] and scurfing of the bark, is observed frequently on Valencia, Lue Gim Gong, and Star Calyx sweet oranges in Florida and has been known to occur in Argentina. Bark symptoms, confined to the scion portion of the trunk and adjacent parts of main limbs, are obscure and easily overlooked. The scurfy patches, formed of horizontal ridges of corky pimples, decrease in size with distance from the bud union, and occasionally encircle the trunk or branch. The underlying cortical tissues are impregnated with a dark brown, gummy substance. Leaf symptoms are very conspicuous. The blades are markedly twisted, mature leaves of the terminal flush being the most distorted, are abnormally erect, and appear to clasp the stem. Chlorotic islands, usually at the base of the leaf just above the wings and varying in size from narrow streaks to one-quarter of the leaf surface, persist sometimes down to the fourth flush.

Tests started in 1948 at the Citrus Experiment Station, Florida, indicate that the disorder is propagated in the scion but is not of virus origin, and is not related to psorosis. It does not reduce production or weaken the tree, but affected trees should be avoided.

Chevalier (A.). **Recherches sur les Phoenix africains.** [Researches on African species of *Phoenix*.]—*Rev. Bot. appl.*, 32, 355–356, pp. 205–236, 1 fig., 1952.

In the part of this paper dealing with diseases affecting date palms in North Africa (Algeria, Tunis, and Morocco) the author states that *Graphiola phoenicis* [*R.A.M.*, 26, p. 131; 31, p. 33] is very prevalent in unfavourable regions. *Thielaviopsis* [*Ceratocystis*] *paradoxa* [14, p. 429] is also present. In seasons marked by a rainy spring rather severe damage is caused in Cyrenaica and Morocco by *Mauginiella scaettae* [17, p. 507; 22, p. 468; 30, p. 585]; in some years the disease is present from Morocco to Egypt and in 1951 the author observed it on *Phoenix atlantica* at Marrakesh, Morocco. By far the most dangerous disease is 'baïoud' (*Fusarium albedinis*) [C.M.I. map No. 240], which at present constitutes a threat to all the date palms in the region of Tafilalet, Morocco.

Castaño (J. J.) & Escobar (G. B.). **Un método práctico para combatir el 'mal rosado' del Cafeto.** [A practical method of combating the 'pink disease' of the Coffee bush.]—*Agricultura trop.*, 9, 7, pp. 53–57, 3 figs., 1953.

A popular account is given of pink disease (*Corticium salmonicolor*) of coffee in Colombia, where it was first detected in 1933 [C.M.I. map No. 122], with directions for its control by rational cultural measures and spraying with perenox (400 gm. per 100 l.) at a dosage of 2 to 4 l. per tree.

Tarr (S. A. J.). **Seed treatment against blackarm disease of Cotton in the Anglo-Egyptian Sudan. Parts II and III.**—*Emp. Cott. Gr. Rev.*, 30, 2, pp. 117–132; 3, pp. 182–191, 1953.

In further work on the control of seed-borne blackarm disease of cotton (*Xanthomonas malvacearum*) [*R.A.M.*, 33, p. 81 and following abstract] more effective control was obtained by steeping seed in abavit B (mercuric chloride and mercuric iodide 3:1) than by using the bactericide as a dust. Soaking the seed in water for one hour followed by an hour's mercurial steeping was as effective as a two-hour mercurial steep and less injurious. Equally good protection was given by organo-mercury compounds (two-hour steep), including ethyl mercury phosphate and R1489. The slight residual infection, obtaining even after the most drastic treatment of acid-delinted seed, suggests that it arises from internal infection. Of the slurry treatments tested R1489 at 22·5 ml. per lb. reginned seed was superior to standard abavit and warrants further trials. Other slurries were fully effective only on delinted seed.

Soaking the seed in irrigation water greatly reduced seed-borne blackarm at 35° C., and slightly at 10°; it was not significantly more effective than sterile distilled water. This action is considered to be due rather to the development of a bacteriophage [13, p. 696] than to anaerobic conditions [21, p. 198]. Seed injury during this process was due to germination and fermentation.

Soaking Sakel seed for more than a few hours in a 0·2 per cent. mercuric chloride-iodide solution was injurious, germination, seedling, and root development becoming progressively more impaired as the duration of the steeping increased. Similar results followed when the strength or (to a less extent) the volume of solution was increased. Acid-delinted seed was much more susceptible to mercury injury than undelinted seed, and decorticated seed even more so, injury to the acid-delinted increasing with longer prior exposure to the acid. Sakel seed germinated in 0·002 per cent. mercuric chloride-iodide solution, but only very slightly in one of 0·02 per cent., germination being progressively inhibited by increasing concentration. The injurious effects of some mercurial steeps sometimes increased on acid-delinted seed with prolonged storage, but not with undelinted seed. The flotation method of estimating germinative capacity was unreliable when applied to seed injured by toxic doses of mercury salts.

Wickens (G. M.). **Bacterial blight of Cotton.**—*Emp. Cott. Gr. Rev.*, 30, 2, pp. 81–103, 1953.

A brief survey (with 53 references) of present knowledge of the symptoms and occurrence of the chief pathogen of African rain-grown cotton, *Xanthomonas malvacearum* [see preceding abstract], includes discussions on the factors influencing the occurrence of infection in different parts of the cotton plant, and those influencing the development of the bacterium within the plant, as well as the ways in which the disease is carried over from one growing season to the next and is disseminated amongst the crop. Control methods are centred on chemical treatment of the seed [loc. cit.]. The breeding of resistant varieties holds great hope, and should be carried out in each region to test the plants under conditions obtaining there. The gene combination B_2B_6 [cf. *R.A.M.*, 32, p. 374] might confer immunity. An appendix describes the large-scale methods of inoculating plants used at Mamulonge, Uganda [loc. cit.].

[This paper is also published as *Res. Mem. Emp. Cott. Gr. Corp.* 15, 23 pp., 1953.]

Miège (E.). **L'avenir de la culture du Cotonnier en Afrique du Nord et spécialement au Maroc.** [The future of the cultivation of the Cotton plant in North Africa and particularly in Morocco.]—*Rev. Bot. appl.*, 32, 355–356, pp. 236–253, 1952.

In 1950 the cotton crop at Sidi-Slimane, Morocco, displayed symptoms resembling those of wilt [unspecified] or leaf curl and *Bemisia gossypiperda* was observed in the locality. Sore shin due to a *Rhizoctonia* [? *Corticium solani*: cf. *R.A.M.*, 11, p. 454] was reported.

Investigations into yellow-leaf disease of Phormium.—*N.Z.J. Sci. Tech.*, Sect A, 34, *Suppl.* 1, 46 pp., 1 col. pl., 25 figs., 2 graphs, 1953.

This is a detailed summary of the work carried out in New Zealand on the yellow leaf disease of *Phormium tenax* [*R.A.M.*, 31, p. 606], some of which has been noticed from time to time in this *Review*. It includes a review of the history and symptomatology by W. R. Boyce and F. J. Newhook (pp. 1–11), descriptions of translocation disorders by K. Strzemienski (pp. 12–16), anatomical aspects by F. J. Newhook (pp. 17–30), experimental induction of the disease condition with the help of the insect vector, *Oliarus atkinsoni* [loc cit.], by R. A. Cumber, and transmission experiments and discussion of control by Sheila W. Boyce, W. R. Boyce, E. E. Chamberlain, P. R. Fry, R. E. F. Matthews, and F. J. Newhook. The disease, first observed in 1908, is now widespread throughout the North Island, not only in the mill areas, but in undeveloped swamps and isolated places, and is present in many districts of the South Island, though not in epiphytotic proportions. It has been detected on *P. colensoi*, which is highly susceptible.

Symptoms not previously noted include premature flowering, discoloration of the vascular system of the rhizome, and longitudinal leaf rolling. Diseased plants may be distinguished from healthy ones in the incipient stages by the pallor of the leaves, particularly at the apex, and later by the fact that usually more than two leaves per fan are yellowed. Yellowing coincides with the period of maximum growth, appearing in August, reaching a peak from December to February, and sometimes disappearing from March to July. No cases of true recovery have been observed. The incubation period in young seedlings is a few weeks but in older plants may be one to three years. At Moutoa, one cultivar, SS, has shown over a period of 14 years a high degree of resistance to or tolerance of the disease under a wide range of field conditions. There are also indications of resistance in 311 and Tihore.

The blockage of translocation in affected plants has been demonstrated by means of dyes and radio-phosphate solutions, the rhizome being the most probable seat of this blockage, where phloem necrosis and xylem gummosis occur extensively.

These symptoms are also present in the leaves but are rare in the roots. They regularly precede root collapse, rhizome rot, and leaf yellowing.

Further work on transmission by the insect vector confirmed the preliminary findings that the insect can reproduce the disease, full symptoms following colonization by as few as two individuals in under four weeks. Preliminary experimental work indicates that a virus is probably involved. The disease was also transmitted readily under suitable conditions by leaf rubbing with infected sap, symptoms appearing in 16 out of 49 plants after 4 to 6 months and in 33 after 16 to 21 months. A few cases of root-graft transmission have been observed and there is evidence of seed transmission. The virus responsible for the disease is believed to be endemic to the New Zealand area. Attempts to transmit symptoms by insect inoculation to indicator hosts of a number of commonly occurring viruses were negative. Probable control measures will include control of the insect vector by flooding and other means, elimination of infection sources in nurseries and plantations, and breeding for resistance.

Sarejanni (J. A.). **Un Phytophthora du collet des Œillets.** [A *Phytophthora* attacking Carnations at the collar.]—*Ann. Inst. phytopath. Benaki*, 6, 1, pp. 32–36, 1952.

A few years ago over 50 per cent. of potted carnation slips at Chalandri, Greece, were affected by a disease characterized by slight loss of turgidity and a deeper leaf colour than normal. The plant wilted gradually from the base upwards and an oil spot, later a lesion, developed at the collar or at the base of an affected branch. Over 40 per cent. of the mother plants in the field were also affected, displaying either general wilting and yellowing of the leaves and stems or sustaining a partial attack involving only a few branches. *Phytophthora parasitica* var. *macrospora* was isolated from the affected and adjoining tissues [*R.A.M.*, 16, p. 158].

Control may be effected in the field by destroying affected plants at the first sign of disease, and disinfecting the main irrigation channel with a small bag containing about 1 kg. copper sulphate [see below, p. 276]. Slips should be taken only from healthy plants and dipped in Bordeaux mixture containing 0·8 per cent. copper sulphate plus a wetter before potting; infected soil should be used only if previously steamed.

Barthelet (J.). **Le mildiou de l'Œillet.** [Carnation mildew.]—*Ann. Inst. Rech. agron.*, Sér. C (*Ann. Épiphyt.*), 4, 2, pp. 173–183, 5 figs., 2 graphs, 1953.

This paper on carnation mildew (*Peronospora dianthicola*) in France is a slightly expanded account, with a complete description of the fungus, of work already noticed from another source [*R.A.M.*, 26, p. 301].

Milstrey (R. A.), Stewart (R. N.), & Jeffers (W. F.). **Retention of virulence of lyophilized cultures of Pseudomonas caryophylli.**—Abs. in *Phytopathology*, 43, 7, p. 406, 1953.

Pseudomonas caryophylli [*R.A.M.*, 31, p. 328] quickly loses its virulence in culture, and tests of various media and methods of storage in the United States for the maintenance of virulence showed that only a lyophilized culture [cf. 32, p. 15] and one on carnation infusion agar kept under mineral oil [cf. 31, p. 313 and below, p. 245], tested after storage for eight months, caused a higher incidence of infection in inoculation experiments on carnation than did the control culture.

Buxton (E. W.) & Robertson (N. F.). **The Fusarium yellows disease of Gladiolus.** —*Plant Path.*, 2, 2, pp. 61–64, 1 pl. (between pp. 54 and 55), 1953.

This is a preliminary account of the status of *Fusarium* yellows of gladiolus plants in Britain. The first signs of yellowing appear simultaneously in the terminal 3

to 6 in. of the outer leaves, where an interveinal, pale green mottle quickly changes to bright yellow stripes. The stripes progress towards the base, the tips turning yellowish-brown and the veins at the tip brown. In severe infections all the above-ground parts rapidly die back. The degree of yellowing and the rate of die-back vary with different isolates of the *Fusarium*.

Symptoms are almost identical on both fibrous and dropper roots, though on the latter the lesions are somewhat larger, more sparse, and mostly confined to the under side. Small, pale brown lesions are present at all points along the root, mostly at the tip, later at the crown, and there are also brown necrotic stripes up to 2 in. long. Root girdling occurs later, especially at the crown, and the cortex sometimes sloughs off. The lesions darken, many turning black. A cortical rot extends inwards, delimited by a dark brown zone of cells with thick dark walls, often filled with a brown resinous substance. Penetration of the endodermis with, ultimately, invasion of the root vessels is common, hyphae being present in the stelar cells. Fragments of surface-sterilized roots with brown lesions invariably yield the *Fusarium*.

In the early stages just above the basal plate of infected corms there is a blackened ring of root bases and conspicuous discoloration of the vascular core; the fungus is present in the discoloured tissue and in the clean tissue in advance of it. The radiating vascular strands of the corm core may turn dark brown and produce surface lesions. Three major corm symptoms were internal browning with no external symptoms at first, but with ridged surface rot at the nodes after storage; ridged basal corm rot not affecting the vascular core [*R.A.M.*, 6, p. 34]; and a dry core rot of corms in storage, with no surface lesions except a dry hardness of the basal plate.

In inoculation experiments at the Botany School, Cambridge, from 1950 to 1952 isolates from corm lesions, ridged surface rot of a stored corm, and the corm cores of yellowed plants all gave rise to typical yellows.

Examination of selected isolates from a collection of 150 from corms and roots of yellowed plants indicated that within the morphological boundaries of *F. orthoceras* var. *gladioli* [23, p. 345] and *F. oxysporum* var. *gladioli* there may be a range of forms which can cause yellowing. It is suggested that the fungus be incorporated in *F. oxysporum* f. *gladioli*, as described by Snyder and Hansen [19, p. 495].

The disease has been found in corms from Holland [30, p. 107] received in Britain. It occurs in Ayrshire, Cambridgeshire, Cornwall, Midlothian, and Surrey. The varieties Picardy and Bit of Heaven were the only ones showing resistance [cf. 33, p. 73], 33 others being affected.

Corms grown for sale can be kept relatively unaffected, if selected from initially healthy stocks, by careful roguing and adequate rotation. Resistant varieties could be produced if desired.

Brierley (P.) & Smith (F. F.). **Tomato ringspot virus in the florists' Hydrangea.**—Abs. in *Phytopathology*, 43, 7, p. 404, 1953.

Tomato ring spot virus isolated from *Hydrangea macrophylla* [*R.A.M.*, 32, p. 316] induced in 15 test species symptoms agreeing with those of Price's tomato ring spot virus [28, p. 492]. The virus was manually transmitted to *H. macrophylla* in June and from tobacco to seedlings of the former in July. The virus from *H. macrophylla* and the type strain, inoculated into hydrangea seedlings in November, each produced chlorotic ring patterns in one out of ten plants in January. The young leaves of Stafford hydrangeas, inarch-grafted to plants with rugose mosaic in June, exhibited yellow mottling in the following January, suggesting the implication of a second virus. Insect transmission experiments have given negative results to date.

Brown (J. G.) & Scandone (T. G.). **A bacterial parasite of Tamarisk.**—*Plant Dis. Reptr*, 37, 10, pp. 524–525, 3 figs., 1953. [Multilithed.]

An [unidentified] bacterium was isolated from dead and dying tamarisks (*Tamarix pentandra*) in all tamarisk areas in Arizona, New Mexico, and Texas. Studies carried out conjointly by the United States Reclamation Service and the Arizona Agricultural Experiment Station, Tucson, demonstrated its remarkable heat resistance; it was not killed in suspension after 10 minutes at 98·5° C. though subsequent growth was retarded. When grown on solid media streptococcus-like colonies developed, individual cells being straight rods that could become motile when free. In greenhouse inoculation experiments tamarisk leaves, twigs, and entire rooted cuttings were killed, and the bacterium was re-isolated. In the field the host parenchyma is attacked, affected parts collapse, and masses of foliage turn brown and hang in formless bunches on the plant. This appears to be the first bacterial parasite recorded on tamarisk, a most troublesome weed which is difficult to eradicate.

Klesser (P. J.). **Virus diseases of Lupins.**—*Fmg in S. Afr.*, 28, 331, pp. 347–350, 13 figs., 1953.

Five different types of virus have been isolated from lupins [*R.A.M.*, 32, p. 613; 33, p. 71] in the Western Provinces of South Africa and the Transvaal.

White lupins newly infected with virus 1 develop small chlorotic leaf specks which spread until the whole leaf is malformed and chlorotic with occasional raised, dark green areas. The smallest leaves drop, leaving the petiole bare. Young leaves of blue lupins develop necrosis and drop. The necrosis spreads downwards causing most of the leaves to drop and the stem to dry out and collapse.

Virus 2 on white lupins causes vein-yellowing and chlorotic spotting of the young leaves and wavy, twisted margins. The leaves formed later are severely misshapen and chlorotic with irregular, dark green areas. If the plant is well established when infected only the top becomes rosetted and shows the first leaf symptoms. Blue lupins develop a slight, chlorotic leaf mottle followed by necrosis originating just below the growing point and running down the stem; the plant finally collapses.

Leaves of white lupins infected with virus 3 develop vein-yellowing and chlorotic spotting followed by upward rolling and downward bending of the leaflets. Later they are malformed with broad, dark green bands along the midrib. Plants infected when young collapse from stem necrosis. The effects of viruses 3 and 4 on blue lupins are very similar to those of virus 2.

On white lupins virus 4 induces vein-clearing and necrotic speckling which extends to the growing point. The young leaves die back and the plant may produce secondary shoots with misshapen, necrotic leaves bearing dark green marginal blisters.

The young leaves of white lupins infected with virus 5 develop chlorotic mottle and are rolled tightly downwards. Blue lupins have a preliminary chlorotic mottle followed by characteristic rosetting at the top of each stem. In severe cases the plants reach a height of only 3 or 4 in. The leaves are generally distorted and curled and the internodes very short.

Each virus is aphid-transmitted. Prevention of spread lies in controlling the aphids and maintaining plant vigour at a high level with fertilizers.

Held (V. M.) & Haenseler (C. M.). **Cross-inoculation with New Jersey isolates of Sclerotinia sclerotiorum, S. minor, and S. trifoliorum.**—*Plant Dis. Reptr*, 37, 10, pp. 515–517, 1953. [Multilithed.]

At New Jersey Agricultural Experiment Station, Rutgers University, and the Department of Plant Pathology, New Brunswick, the virulence of *Sclerotinia sclero-*

tiorum [*R.A.M.*, 32, p. 66] and *S. minor* [30, p. 370] from lettuce and of *S. trifoliorum* [see next abstract] from field soil in which lucerne and Ladino clover had been planted was assessed on a variety of crops under greenhouse conditions highly favourable to mycelial development of the pathogens. *S. minor* was the most virulent, killing lucerne, red clover, lettuce, Swiss chard, spinach, beet, cantaloupe, cabbage, tomato, [chilli] pepper, snap bean [*Phaseolus vulgaris*], soy-bean, and tobacco. *S. sclerotiorum* killed all except red clover, beet, and tobacco. *S. trifoliorum* was lethal only to lucerne, clover, lettuce, and tomato. It is suggested that under favourable conditions *S. minor* might be of greater importance than *S. sclerotiorum*. In New Jersey it causes severe losses of field-grown lettuce, but has never been observed on lucerne and clover. *S. trifoliorum* may be responsible for the severe attacks of lettuce drop occasionally observed in crops planted for the first time in fields previously sown with clovers and lucerne.

Graham (J. H.) & Hanson (R. G.). **Field inoculation of Red Clover with Sclerotinia trifoliorum.**—*Plant Dis. Reptr*, 37, 10, pp. 518–520, 1953. [Multilithed.]

Successful artificial field inoculations of red clover with *Sclerotinia trifoliorum* [*R.A.M.*, 32, p. 486 and preceding abstract] were obtained at Pennsylvania State College from 1950 to 1953 by scattering ground, dried-grain inoculum (1 to 12 gm. per sq. ft.) over the plants in November. The exact rate of application necessary depends on the environment.

Gerdemann (J. W.). **An undescribed fungus causing a root rot of Red Clover and other Leguminosae.**—*Mycologia*, 45, 4, pp. 548–554, 7 figs., 1953.

In this full account of studies on a root rot of red clover (*Trifolium pratense*) in Illinois [*R.A.M.*, 32, p. 383] it is stated that the fungus was shown by further inoculation experiments to be pathogenic to soy-bean, *Lespedeza stipulacea*, *Lotus corniculatus*, *Melilotus alba*, pea, and clovers (*T. hybridum*, *T. incarnatum*, and *T. repens*). It was also found on dead red clover in Maryland and reported on diseased lucerne in Virginia.

A new genus, *Leptodiscus*, erected to accommodate the fungus, has the characters: small, black, spherical to fusiform sclerotia; superficial, yellow to dark brown, scutiform acervuli, developing radially from a central cell to form a thin stroma, one cell layer thick; conidiophores evanescent; conidia hyaline, uniseptate, bearing a filamentous seta at each end, and produced on the upper surface of the stromatic cells in linear rows in mucus, the mass forming a light yellow to brown head. The species, *L. terrestris* n.sp., is characterized by sclerotia 1 mm. long, a peltate stroma 200 to 800 μ in diameter, and allantoid spores 20 to 34·8 by 4·4 to 7 μ, with setae 8·7 to 18 μ long.

Wells (H. D.). **Diseases of big Trefoil in Georgia.**—*Plant Dis. Reptr*, 37, 10, p. 521, 1953. [Multilithed.]

During 1952–3 a survey was made of the diseases of *Lotus uliginosus* in pastures at the Alapaha Range Station, Georgia, and in small plots at the Georgia Coastal Experiment Station, Tifton. Four diseases were observed, each with similar gross symptoms but readily distinguishable upon close examination in the field. Aerial or summer blight (*Rhizoctonia* [*Corticium*] *solani*) [*R.A.M.*, 31, p. 19; 32, p. 192] is characterized by rapid blighting of leaves and stems, both of which turn beech tan colour and die off, in hot, humid weather from May to September. Anthracnose (*Colletotrichum truncatum*), causing leaf and stem blight as well as leaf spot, develops water-soaked areas less than 1 mm. in diameter which in dry weather become cinnamon brown, later Indian tan on the stems, gradually spreading over the entire leaf surface and girdling the stems. In damp weather dead leaflets and

stem lesions turn chaetura black. The dark acervuli and setae can be observed through a hand-lens. Southern blight (*Sclerotium rolfsii*) [cf. 31, p. 332], is recognizable by the white, cottony growth of mycelium along the margin of blighted areas on the leaves and stems and by the small, brown sclerotia immediately behind the margin. The unidentified fungus responsible for black patch disease [cf. 33, p. 32] causes leaf and stem blight during warm weather from April to October, the affected parts turning dusty green and then chocolate brown.

Kernkamp (M. F.) & Hemerick (G. A.). **The relation of Ascochyta imperfecta to Alfalfa seed production in Minnesota.**—*Phytopathology*, 43, 7, pp. 378–383, 2 figs., 1 graph, 1953.

The writers have already shown (abs. in *Phytopathology*, 42, p. 468, 1952) that black stem (*Ascochyta imperfecta*) is a contributory factor in the reduction of lucerne seed yields in Minnesota, and further evidence to this effect was provided by the greenhouse tests herein reported. The pathogen can, in fact, virtually suppress seed production in plants atomized with spore suspensions during the fruiting stage. All the seeds harvested from such plants were light (mean weight of 0·75 mg.) compared with the uninoculated (2·22 mg.), while on selected field plots there was also a third category, intermediate (1·62 mg.). Light, chaffy seeds are blown out of a threshing-machine and occur only in small numbers in commercial seed, but the intermediate and heavy also frequently develop infection, which can be detected in germination tests. It would appear from these results that seed-borne infection by *A. imperfecta* is of extreme importance in the initiation of seedling blight and seasonal epiphytotics of black stem.

Seed treatment has consistently failed to eliminate the pathogen [but see *R.A.M.*, 25, p. 119], and in 1950 spraying and dusting experiments were unsuccessful. Crop rotation reduces the incidence of infection because at least two seasons are required for the accumulation of sufficient inoculum to produce a severe outbreak. The only hope of effective control would appear to lie in the development of resistant varieties [28, p. 293]; indications of resistance have been observed within individual clones [32, p. 542].

Among the 19 other species of legumes reacting positively to inoculation with *A. imperfecta* [besides some already mentioned in previous papers] were groundnut, pigeon pea, *Cyamopsis tetragonoloba*, *Medicago falcata*, crimson clover, *Phaseolus aureus*, *P. calcaratus*, bean (*P. vulgaris*), field pea (*Pisum arvense*), *Stizolobium deeringianum* [*Mucuna deeringiana*], and cowpea.

Anderson (A. J.). **The significance of sulphur deficiency in Australian soils.**—*J. Aust. Inst. agric. Sci.*, 18, 3, pp. 135–139, 1 fig., 1952.

Pot culture experiments at the Division of Plant Industry, Canberra, in 1948 demonstrated the occurrence of sulphur deficiency in three soils from the Southern Tablelands of New South Wales [cf. *R.A.M.*, 32, p. 563]. Subsequently, responses to sulphur and phosphorus, with marked interaction between the two elements, were observed when plants (including subterranean clover [*Trifolium subterraneum*: loc. cit.]) were grown on four soils of different origin from the same region. Sulphur deficiency has also been recorded [cf. 32, p. 565] in a number of soils in Western Australia, and in soils of basaltic and granitic origin on the Northern Tablelands of New South Wales.

On one soil from the Southern Tablelands deficient in both sulphur and phosphorus excellent clover was developed with applications of superphosphate. Experiments made to test superphosphate as a source of available phosphorus should take into account the possible influence of the sulphur content. Under conditions of high rainfall sulphur deficiency may develop more rapidly than phosphorus deficiency on land previously treated with superphosphate. However, a single initial applica-

tion to pasture on the Southern Tablelands was as effective as correspondingly lighter annual dressings. No sulphur deficiency symptoms were apparent on any plants grown on the treated soil four years after the application.

There is some evidence that fallowing increases the available sulphur and nitrogen.

ANDERSON (A. J.). **Responses of subterranean Clover and Lucerne to boron.**—*J. Aust. Inst. agric. Sci.*, 18, 3, pp. 159–163, 1952.

In field trials established in 1946 to test the effects of essential elements on pasture at the Division of Plant Industry, Canberra, and in the Young, Boorowa, Crookwell, and Goulburn districts of the Southern Tablelands of New South Wales responses of subterranean clover (*Trifolium subterraneum*) and lucerne to boron [*R.A.M.*, 32, p. 563] were obtained, the residual effect of an initial dressing of 3½ lb. of borax per acre still being apparent after six years. On soil deficient in molybdenum [loc. cit.] the response to boron was increased where molybdenum was also applied.

MCLACHLAN (K. D.). **Effects of lime and copper on subterranean Clover grown on acid soil.**—*Aust. J. agric. Res.*, 4, 2, pp. 151–159, 2 pl., 1953.

In a field experiment on two acid podsolized soils near Heytesbury, Victoria, in which nutrient elements were tested on a *Phalaris tuberosa-Trifolium subterraneum* pasture, lime increased the clover yield at both sites, the effect being greater in the area cleared from timber and heath than in reclaimed heath.

In the latter area, where copper deficiency [*R.A.M.*, 32, p. 563] was severe, copper increased the yield both with and without lime, but the effect was much greater with lime. Copper increased the number of plants per unit area and the yield of individual plants. In the area cleared from timber copper decreased yield in the absence of lime.

Marginal necrosis is described as an additional symptom of copper deficiency in subterranean clover.

THIRUMALACHAR (M. J.) & WHITEHEAD (M. D.). **A Physoderma disease of Barnyard grass.**—*Science*, 118, 3075, pp. 693–694, 2 figs., 1953.

Leaves of barnyard grass (*Echinochloa crusgalli*) collected near Patna, India, infected by a *Physoderma* were growing in fields of maize infected by *P. maydis* [*R.A.M.*, 30, p. 248]. Comparative morphological studies indicated that the two fungi are separate species. The sori of the species on *E. crusgalli* are not erumpent. In cross-inoculation experiments at College Station, Texas, *P. maydis* from maize severely infected maize, but did not attack *E. crusgalli*. In corresponding experiments in India the barnyard grass *Physoderma* attacked only *E. crusgalli*. No barnyard grass has been found infected by *Physoderma* in Texas, though maize locally is severely attacked by *P. maydis*. The fungus is presented as a new species, *P. echinochloae*. The resting sporangia have a circumscissile lid and measure 18 to 26 by 10 to 16 μ.

RAMAKRISHNAN (T. S.). **Observations on ergots on Pennisetum and other grasses.**—*Proc. Indian Acad. Sci.*, Sect. B, 36, 3, pp. 97–101, 1952. [Received 1953.]

In November, 1950, the plants in a group of allotetraploid hybrids of *Pennisetum typhoides* × *P. purpureum* at the Millets Breeding Station, Coimbatore, India, were attacked by an ergot (*Claviceps* sp.) [*R.A.M.*, 25, p. 167]. Germination of the sclerotia could not be induced but the conidia were infective after 13 months, this providing the fungus with a method of survival from year to year. The conidia infected six species of *Pennisetum* and two of *Cenchrus*, but not *Brachiaria ramosa*. The alkaloid content of the sclerotia varied according to the host, those on *Pennisetum* spp. having a low content; thus there is no danger to grazing stock. In

other parts of the State ergots were observed on *Urochloa setigera* and *B. ramosa*. The fungus from the former infected *Pennisetum* hybrids. The ergotoxine content of *B. ramosa* sclerotia was high (0·8 per cent.).

Jones (D. R. H.). **Variation in culture of Fusarium culmorum.**—*Nature, Lond.*, 173, 4392, pp. 37–38, 2 figs., 1953.

When macroconidia of *Fusarium culmorum*, isolated from the rhizosphere of healthy cocksfoot (*Dactylis glomerata*) plants at the Grassland Research Station, Stratford-on-Avon, were germinated in certain watery media in van Tieghem cells at 20° and 25° C., in 24 hours fusions of germ-tubes were observed between two to six neighbouring macroconidia less than 80 μ apart, resulting in the formation of variants [cf. *R.A.M.*, 28, p. 447]. Further tests showed that the reaction (pH 6 to 9) of the medium is an important factor influencing germ-tube fusion. On certain media fusion of hyphae from two different colonies was common at pH 6 to 8 but did not always lead to variant formation. Growth of the fungus in glucose-peptone solution and Richards's solution for 28 days at 25° caused the pH to rise from 5·4 to 8·5 in the former and 5 to 7·4 in the latter [cf. 29, p. 46]. Fusion of germ-tubes was more common when the inoculum was taken from the centre of 28-day-old cultures than from the margins, and this is attributed to differences in pH. The four types of variants obtained were similar to those observed by Brown [7, p. 475], namely pionnotal, long-spore, mycelial, and sporodochial types identical with the wild form but growing far more rapidly.

Hall (E. G.), Sykes (S. M.), & Trout (S. A.). **Effects of skin coatings on the behaviour of Apples in storage. II. Common storage investigations.**—*Aust. J. agric. Res.*, 4, 3, pp. 264–282, 7 pl., 1953.

Part I of this series was concerned with physiological and general investigations (*Aust. J. agric. Res.*, 4, pp. 57–81, 1953).

In trials carried out from 1940 to 1945 in Australia with skin coatings [*R.A.M.*, 23, p. 303; 31, p. 610] on apples in unrefrigerated storage the best results were given by C.O.S., an 8 to 10 per cent. alcoholic solution of castor oil and wax-free shellac (2:1). With Granny Smith apples this treatment (in New South Wales) reduced commercial wastage in 29 of 35 experiments by 18 to 100 (average 53) per cent.; in the remaining six it increased wastage, mainly by the development of lenticel spot [30, p. 169]. Wrapping the treated apples in plain tissue wraps as soon as the C.O.S. coating had dried reduced commercial wastage by 25 per cent., mainly by controlling lenticel spot. Commercial wastage decreased with increasing concentration of the coating from 5 to 12½ per cent.

Rotting by moulds (chiefly *Penicillium* spp. and *Botrytis cinerea*) [cf. 31, p. 570] was reduced by C.O.S. in 19 of 31 trials; it increased with advancing maturity.

Late scald and lenticel scald [24, p. 92] were consistently reduced by 7½ per cent. C.O.S. and effectively controlled by 10 per cent. Lenticel spot was increased by 7½ per cent. C.O.S. in 15 experiments and reduced by it in one, and was increased by 10 per cent. C.O.S. in four, reduced in two, and unaffected in six. In untreated lots lenticel spot generally occurred only on senescent, yellow fruit and was not readily distinguishable from spot on coated fruit, but it often developed into lenticel scald. On coated fruit most of the lenticel spot was produced by the alcohol, pure alcohol causing heavy spotting, which was gradually reduced by adding increasing amounts of castor oil and shellac. The condition appeared in two to three weeks on coated fruit and much later on the controls. It was often severe on treated immature fruits, though individual spots were seldom larger than pinhead size.

Core flush [30, pp. 17, 47] was generally increased by C.O.S.; bitter pit [30, p. 404] was reduced, the 10 per cent. concentration lowering incidence by 80 and 70 per cent. and the 7½ per cent. by 63 and 26 per cent.

In ten experiments coatings of emulsified medicinal paraffin, peanut oil, or mixtures of them reduced wastage, especially when late scald was severe in the untreated, this disorder invariably being well controlled. Peanut oil, even when well emulsified, caused calyx injury and increased mould wastage, but reduced total wastage.

Wax emulsions caused calyx browning and rotting [unspecified], severity depending on the alkalinity and concentration of the emulsion. They retarded the development of skin blemishes (e.g., lenticel spot), but were less effective in controlling senescent scalds, though less apt to increase core flush. Waxing did not consistently reduce commercial wastage.

Mixed emulsions of waxes and paraffin or peanut oil were less effective than oils alone in controlling senescent disorders. They frequently caused lenticel and calyx injuries and increased commercial wastage. Shellac (1 part) dissolved in 3 per cent. ammonia and added to oil or wax emulsions (2 parts) improved wastage control. Comparative tests indicated that commercial wastage was reduced by C.O.S. and increased by most of the other coatings, which increased mould and calyx injury, emulsions high in soap being particularly deleterious.

In a commercial-scale trial in Tasmania 10 per cent. C.O.S. increased the common storage life of Granny Smith from 8 to 14 weeks by retarding ripening, colouring, and softening.

In large-scale tests in Western Australia with Granny Smith apples 10 per cent. C.O.S. (4:1) did not prove satisfactory. In two experiments in South Australia 8 per cent. C.O.S. increased the storage life of Granny Smith apples by six weeks.

On Jonathan apples the best concentration of C.O.S. was 10 per cent., which often reduced commercial wastage even when slight lenticel injury increased total wastage. Lenticel spot was more severe in fruit coated with lower concentrations of C.O.S. All concentrations controlled Jonathan spot. Mould wastage was low in New South Wales fruit and was unaffected by C.O.S., while bitter pit was reduced in the few experiments in which it occurred. In Tasmania 10 per cent. C.O.S. reduced Jonathan spot from 29 per cent. to 3 per cent. and mould wastage from 26 per cent. to 10 per cent. In several trials in South Australia Jonathan spot was controlled, mould reduced, commercial wastage diminished, and storage life prolonged. Coatings of the less alkaline emulsions of vegetable oils caused lenticel injury. A 10 per cent. emulsion of mixed waxes (paraffin plus lac or carnauba) with a mildly alkaline soap (e.g., ammonium or morpholine oleate) controlled Jonathan spot and increased the storage life of medium-sized fruit picked at normal cool storage maturity by 50 per cent., when the average temperatures during the first two weeks did not exceed 65°. Wax emulsions containing shellac were also successful with this variety.

With Delicious the best coating tested was a 10 per cent. emulsion of paraffin wax with lac or carnauba wax (3:1), storage life of fruit picked at cool storage maturity being about six weeks at 64° and 13 weeks at 45° to 50°, as compared with four and eight weeks, respectively, for untreated fruit.

Wastage in Democrat apples of normal cool-storage maturity was caused mainly by blue mould (*Penicillium* spp.), which was reduced by alcoholic solutions and increased by emulsions. Treatment with 10 per cent. C.O.S. gave appreciable but variable increases in storage life. C.O.S. (8 to 10 per cent.) significantly increased the common storage life of Rome Beauty, provided large fruits and high temperatures were avoided; wastage increased very rapidly with fruit size. The common storage life was also increased by an emulsion containing wax and shellac.

In commercial-scale trials in Tasmania 10 per cent. C.O.S. increased the common storage life of Worcester Pearmain, Cox's Orange Pippin, Cleopatra, French Crab, Crofton, and Sturmer Pippin by an average of 50 per cent. Bitter pit was considerably reduced in those varieties in which it occurred. In Scarlet Pearmain the

coating increased mealy breakdown. In South Australia 8 per cent. C.O.S. increased the storage life of Statesman apples by 50 per cent.

It is concluded that the sensitivity of coated fruit to high temperatures is the factor that most seriously limits the general utility of the method. Direct injuries from coatings can be reduced until they are unimportant compared with the retardation of ripening induced, but the susceptibility of coated fruit to breakdown at temperatures over 70° makes it unsafe to use the more effective coatings on early and mid-season varieties. The main promise of the coatings appear to lie in the treatment of late varieties, especially in the cooler districts.

Moore (M. H.). **Concentrate spraying in fruit plantations : a review of experiments with lime-sulphur.**—*Rep. E. Malling Res. Sta., 1952*, pp. 132–135, 1 pl., 1953.

Experiments were carried out at East Malling to determine the efficacy of high-velocity, fog applications [*R.A.M.*, 32, p. 263] of concentrated lime-sulphur to apple trees for the control of scab (*Venturia inaequalis*) and powdery mildew (*Podosphaera leucotricha*) [cf. 28, p. 295; 33, p. 158]. Over several successive seasons atomized 100 and 50 per cent. concentrates applied to bush Cox's Orange Pippins on MIX rootstocks were at least as effective as the same number of dilute lime-sulphur sprays (2 to 2½ per cent. before and 1 per cent. after blossoming) provided that the deposit was not excessive and that the drops remained discrete. These applications were made chiefly from a paint-gun attached to an air compressor. In the spring of 1952 2½ per cent. lime-sulphur applied hydraulically caused far more leaf scorch than the air-dispersed 100 per cent. concentrate. Similar experiments were conducted on 30-year-old Cox's Orange trees, comparing 100 per cent. lime-sulphur (10 gals. per acre) with 50 per cent. (20 gals. per acre) and also equal quantities per acre of lime-sulphur concentrate applied (*a*) hydraulically at 2½ and 2 per cent. before blossoming and 1 per cent. after, and (*b*) by air dispersal at 10 per cent. before and after blossoming. The higher volumes of spray fluid per acre, including the lower dosages, gave the best scab control and also the most leaf scorch, which would tend to favour control by burning existing lesions and causing infected leaves to drop. This disparity with the results of the small-scale tests is probably due to the difficulty experienced in depositing the fungicide in the required manner on fully-grown trees.

Croxall (H. E.), Gwynne (D. C.), & Jenkins (J. E. E.). **The measurement of losses caused by Apple-tree diseases, with special reference to Apple scab.**—*Ann. appl. Biol.*, 40, 3, pp. 600–603, 1953.

In this paper, read before the Association of Applied Biologists in London on 17th February, 1953, the authors briefly describe their rapid method of estimating infection by apple scab [*Venturia inaequalis*] on leaves [*R.A.M.*, 32, p. 385] and fruit [32, p. 488] and injury by brown rot (*Sclerotinia fructigena*) [31, p. 437]. The scheme suggested for the latter is as follows: no infected fruit on tree, 0 per cent. infection; single isolated infected fruit, 0·1; occasional isolated fruits or trusses, 1; at least one infected apple on every other main branch, 5; or on every main branch, 10; at least two on every main branch, some fallen, 25; every third apple or truss infected, 50; few intact fruit, most fallen, 75.

Croxall (H. E.), Jenkins (J. E. E.), Byrde (R. J. W.), & Marsh (R. W.). **Spraying experiments against Apple and Pear scab at Long Ashton and in the West Midlands, season 1951.**—*J. hort. Sci.*, 28, 3, pp. 196–205, 1 fig., 1953.

Some of this work at Long Ashton Research Station, in 1951 on the control of apple and pear scab [*Venturia inaequalis* and *V. pirina*: *R.A.M.*, 33, p. 158] has been reported from another source [33, p. 92]. The results were paralleled in a

non-replicated trial made in Worcestershire on Worcester Pearmain apples in conditions particularly conducive to infection, where the percentage of scabbed leaf area was reduced from 2·43 and 2·75 (controls) to from 0·27 to 0·7 on the sprayed, the corresponding figures for the fruit being 2·27 and 2·2 (controls) and 0·17 to 0·46 (sprayed).

A 0·125 per cent. heptadecyl glyoxalidine spray equalled lime-sulphur in controlling apple scab, but was not superior to 0·125 per cent. mixed glyoxalidines.

In a plantation of Doyenné du Comice pears heavily infected by scab in Warwickshire four applications of the 0·125 per cent. mixed glyoxalidines reduced fruit infection to one-third of that on the unsprayed blocks, with no damage to the crops.

Bould (C.), Nicholas (D. J. D.), Tolhurst (J. A. H.), & Potter (J. M. S.). **Zinc deficiency of fruit trees in Great Britain.**—*J. hort. Sci.*, 28, 4, pp. 260–267, 2 pl., 1953.

Most of the information in this paper on the symptoms and control of zinc deficiency in apple and pear trees at Wisley, Surrey, has been noticed from other sources [*R.A.M.*, 29, p. 31; 30, p. 233]. The evidence obtained indicated that when the available zinc in the soil, as determined by the *Aspergillus niger* method [31, p. 32 and next abstract], falls below 5 μgm. per gm. (p.p.m.) in the top 6 in. of air-dry soil, the trees may be affected by zinc deficiency. If the value is 1 to 2 p.p.m. the deficiency becomes severe; normal soil contains over 10 p.p.m. and this is the threshold level for the dry matter of leaves and bark of apple trees from July onwards. When the figure falls to 5 p.p.m. or less, little leaves and rosettes appear and the trees become stunted.

Bould (C.), Nicholas (D. J. D.), Tolhurst (J. A. H.), & Potter (J. M. S.). **Copper deficiency of fruit trees in Great Britain.**—*J. hort. Sci.*, 28, 4, pp. 268–277, 4 pl., 1953.

Most of this information on the symptoms and control of copper deficiency in apple and pear trees at Wisley, Surrey, has been noticed from another source [*R.A.M.*, 30, p. 233]. The available copper content of the soil was ascertained to be less than the threshold value of 2 μgm. per gm. air-dry soil as determined by the *Aspergillus niger* method [see preceding abstract]. Oats, wheat, and barley grown on the site developed withertip symptoms, their copper status varying from 2 to 4 μgm. per gm. dry matter.

The deficiency was corrected by applications of copper sulphate to the soil at the rate of ½ lb. per tree, by 4 per cent. copper sulphate dormant sprays, by 0·05 per cent. foliage sprays, and by branch or trunk injections. Bordeaux sprays (4–4–50) caused medium to severe damage to the leaves, especially on pear trees. Response to the treatments was very rapid.

Up to the present, copper deficiency in fruit trees has been diagnosed chiefly on the light, sandy soils of southern England, and, with one exception (an acid Greensand soil), always in association with zinc deficiency.

Termohlen (G. P.). **Het kweken op schurfresistentie bij Appel en Peer.** [Breeding for scab resistance in Apple and Pear.]—*Meded. Dir. Tuinb.*, 16, 7, pp. 519–532, 3 figs., 1 map, 1953. [English summary.]

The breeding of apples and pears [*R.A.M.*, 32, p. 196] for resistance to scab (*Venturia inaequalis* and *V. pirina*) is a new development in Holland, where attention is concentrated mainly on the apple. Resistance is sought principally among crosses between *Malus* spp., including *M. floribunda*, *M. micromalus*, *M. prunifolia*, *M. pumila*, and *M. atrosanguinea* [cf. 29, p. 315; 31, p. 387], and the progeny of

free-pollinated, cultivated varieties of local interest. The seedlings are inoculated with a conidial suspension in a chamber in which high humidity and a temperature of 16° to 20° C. are maintained, the conidia being taken from cultures grown for two to three weeks on cheese-cloth in flasks containing malt agar [cf. below, p. 243]. Resistant individuals are retained and used for back-crossing.

The inheritance of resistance to *V. inaequalis* probably depends on a large number of genes differing in the several species of *Malus* and is thought to be due to unknown substances in the leaf. The fungus comprises an apparently constant population of strains of divergent morphology and pathogenicity [32, p. 386].

Beraha (L.) & Powell (D.). **The vapor phase toxicity of some biphenyl derivatives to Monilinia fructicola.**—*Phytopathology*, 43, 7, pp. 383–386, 1953.

At the Department of Horticulture, University of Illinois, exposure for 16 to 48 hours to *o*-fluorobiphenyl at a concentration of 2,500 p.p.m. completely inhibited spore germination of *Monilinia* [*Sclerotinia*] *fructicola* [cf. *R.A.M.*, 26, p. 111; 33, pp. 165, 166], while shorter exposures (three to five hours) were merely fungistatic. In apple tissue plugs, *o*-fluorobiphenyl, *o*-chlorobiphenyl, *p*-chlorobiphenyl, biphenyl, and polyethyl biphenyl were toxic in the vapour phase at 160 p.p.m., as demonstrated by the absence of rotting after 72 hours. In tests on whole apples punctured and dipped in a spore suspension, *o*-fluorobiphenyl, *o*-chlorobiphenyl, and biphenyl at 2 p.p.m. were the most effective in the prevention of decay in 72-hour exposures; *p*-chlorobiphenyl permitted some degree of rotting but prevented sporulation. However, the toxicants were not fungicidal, since growth was resumed in platings from the exposed tissues. Halogen derivatives were more toxic than those containing the nitro, amino, or alkyl substituents, but all the fungistatic chemicals impaired the flavour of the fruit.

Blumer (S.). **Die Narrenkrankheit der Zwetschgenbäume.** [The pocket disease of Plum trees.]—*Schweiz. Z. Obst-u. Weinb.*, 62, 13, pp. 243–244, 1 fig., 1953.

In June, 1953, *Taphrina pruni* was very prevalent on plums (mostly of the Deutsches Haus variety) in the Zürich district of Switzerland [*R.A.M.*, 26, p. 186]. It was reported to occur almost exclusively on trees that had received no dormant spray [cf. loc. cit.]. It is possible that the mycelium may overwinter on the surface of the branches as well as in the interior, and may be damaged or killed by winter treatments. Pending further information on this aspect of the disease, control should consist in the prompt collection and burial of the 'pocket plums' to prevent further spread by means of the spores.

KenKnight (G.) & Jones (J. F.). **Reduction in incidence of Peach scab as affected by whitewashing trees.**—*Plant Dis. Reptr*, 37, 10, p. 509, 1953. [Multilithed.]

Severe fruit scab (*Cladosporium carpophilum*) was present on peach trees [*R.A.M.*, 28, p. 339] treated with sulphur-parathion in Georgia in 1953. At the United States Horticultural Field Laboratory, Fort Valley, incidence on Elberta trees receiving four sprays of wettable sulphur (6 lb. per 100 gals.), the first three plus 2 lb. of 15 per cent. parathion, was reduced by spraying three times with whitewash (67 lb.). The relative numbers of scab spots per fruit in whitewashed and check plots were in the ratio of 1 to 6.

McIntosh (D. L.). **A trunk and crown rot of sweet Cherry in British Columbia.**—*Phytopathology*, 43, 7, pp. 402–403, 1 fig., 1953.

In 1951 *Phytophthora cactorum* was isolated from a six-year-old sweet cherry tree in the Okanagan Valley, British Columbia [*R.A.M.*, 33, p. 139], affected by a rot girdling the trunk from the crown to several inches above soil-level. Subsequent

surveys of young cherry plantings revealed extensive mortality associated with similar symptoms. Unlike the apple crown rot attributed by Welsh to the same fungus, which develops mainly below the soil surface, this disease involves a large area of the cherry trunk above the ground. Gum deposits are typical and may, in fact, be the first external sign of infection. Discoloration of the bark is seldom perceptible during the first season immediately following an initial attack, while leaf symptoms also are delayed until the disease is well advanced. Trunk girdling in spring may be followed by wilting and death of the leaves at midsummer; in less severe cases the onset of autumn colouring is accelerated. Diseased tissue is tan to dark brown, of a firm consistency, and usually sharply delimited from the sound portion. The above-ground part of the trunk was particularly susceptible in inoculation experiments, the rot spreading rapidly upwards with little downward or lateral extension. From observations on inoculated trees it appears that infection by *P. cactorum* may be active for one season only, no enlargement of the canker taking place in the next year.

Schrödter (H.) & Köhler (H.). **Untersuchungen über den Einfluss der Temperatur auf das Auftreten des Himbeerrutensterbens.** [Observations on the influence of temperature on the occurrence of the dying-off of Raspberry canes.]—*NachrBl. dtsch. PflSchDienst, Berl.*, N.F., 6, 6, pp. 109–116, 6 graphs, 1952.

Experiments were carried out at Aschersleben, Saxony, from 1947 to 1951 on the effect of temperature on the dying-off of raspberry canes caused by *Didymella applanata* and *Leptosphaeria coniothyrium* [*R.A.M.*, 32, p. 262] to supplement the work of Burchard (*Phytopath. Z.*, 1, pp. 294–308, 1930). The three varieties Preussen, Deutschland, and Yellow Antwerp were grown on four plots, which were regularly watered, not watered, fertilized, and unmanured, respectively. The temperatures at the surface of the canes were measured with copper-constant thermoelements three times a day, 50 cm. above ground, near the points of inoculation; the temperature at 1 a.m. was calculated from the minimum night temperature. A fairly reliable average was obtained from these four temperatures. The first series of tests was made in May and June, 1951, on all three varieties on all four plots, the second from July to October on young, newly grown canes of Preussen on the manured plot only.

D. applanata and *L. coniothyrium* gave identical results. The incubation period was shorter in the summer but lengthened towards the autumn, indicating that there was a positive relation between incubation period and temperature. This was represented as two hyperbolas which showed that no development occurred if the temperature fell below 5° C., the thermal end point. This was the same for all varieties and can be taken as the minimal temperature for the development of the disease.

From a mathematical treatment of the relationships between the incubation periods and temperatures the authors conclude that the sum of the average temperatures conditioning the various incubation periods is a constant for a particular variety. The disease appears when a temperature sum reaches or exceeds the constant, which is 134·2° for Preussen and 166·7° for Deutschland and Yellow Antwerp.

Under identical conditions of infection and temperature the disease develops earlier on Preussen; this agrees with greenhouse tests showing this variety to be more susceptible. The fungi need additional warmth to overcome the higher resistance of the other varieties. Observations of the temperature sum in individual cases showed that for each the disease appeared when this constant was reached; this held good for both mature and young canes and in both summer and winter.

With a few discrepancies, a series of calculations gave 5° as the end point and this was also the mean value of all results. The difference between this value and

that of 2° found by Koch [*R.A.M.*, 10, p. 530] and 4° obtained by the authors in previous experiments [31, p. 444] may be due to the fact that it was obtained from field experiments and not in the laboratory and is an average value.

The fact that certain stages of development of the fungi appear when a certain temperature sum is reached has been demonstrated in relation to other parasites, e.g., the maturity of the perithecia of apple and pear scab [*Venturia inaequalis* and *V. pirina*]. The authors point out, however, that it is erroneous to take a definite date as a basic point, without taking into account that temperatures vary from year to year.

The authors' conclusions from their own experiments are that the perithecia of the raspberry dying-off fungi probably mature and the flight of the ascospores begins in spring when an average daily temperature of 5° is reached. To determine the date when infection may occur, the average date when the 5° limit is exceeded must be established. At Aschersleben from 1947 to 1951 the average date for passing the 5° limit was 18th April. In 1951 the date of perithecial maturity was 14th April, that of passing the 5° limit the 15th. From this it is possible to estimate the date for the first appearance of the disease symptoms. For Preussen, Yellow Antwerp, and Deutschland these dates were 11th, 15th, and 16th May, respectively. This agrees with Burchard's work and does not conflict with Koch's results, taking into consideration Canadian climatic conditions.

Ground humidity also exerts some influence on the incubation period and may be of importance in connexion with preventive methods. The experiment showed incubation to be longest, i.e., plant resistance to be strongest, where water was in regular supply, and hence the fluctuation of ground humidity smallest. This was on the fertilized plot, followed by the watered, fertilized and watered, and untreated in that order. However, the date of appearance of the symptoms is primarily determined by the temperature conditions after infection.

The use of a hyperbolic equation does not give an upper limit for the development of the pathogens, but in May high temperatures are extremely rare and it is not likely to be reached. The shortest period of incubation in the field at Aschersleben was nine days in Preussen with an observed average temperature of 20·3°, corresponding to a calculated average of 19·9°. The use of the hyperbola as a functional equation of the dependence of the incubation period on temperature is thus established. Moreover, its successful use in other biological fields seems to indicate that it represents a general law within biological life processes.

Brun (J.). **Le 'bleu' du Bananier en Guinée française.** [Blue disease of Banana in French Guinea.]—*Fruits d'outre mer*, 7, 7, pp. 324–329, 2 figs., 1952.

Blue disease was first observed on banana in French Guinea in 1937–8, occurring in epidemic form in the Benty-Forécariah area; it was endemic around Boffa and Dubreka. It died out in 1941–2 but reappeared with greater intensity in 1945–6, affecting the same areas and also Kindia, Friguiagbé, Coliagbé, and Souguéta. Less severe outbreaks have also been observed at Nieky and round Azaguié in the Ivory Coast.

The disease is characterized by the appearance, particularly during the flowering period, of violaceous spots several mm. in diameter near the base of the petioles of older leaves, eventually multiplying to form streaks reaching the midrib. At this stage the leaf turns slightly chlorotic. The streaks coalesce into irregular bands running parallel with the petiole and midrib and the leaf assumes a characteristic yellow-orange tinge. Finally, it withers completely and the plant may bend in half. A yellow streak runs through the centre of the fruit, which, even if maturing, is seldom fit for sale or transport, being rotten on arrival. The roots of seriously affected plants are brown or black and withered. Attacks may be mild or severe, with extreme symptoms appearing in a few days.

The disorder often began along drainage canals where soil leaching was greatest. It occurred only in years when large quantities of fertilizer were applied. Sometimes one or two affected plants were surrounded by healthy ones. Suckers from affected plants gave rise to healthy ones. An abundant supply of green straw gave some control.

Leaves of diseased plants were deficient in every element except manganese, particularly in nitrogen and magnesium. During March and April, 1951, bananas growing at Benty received the normal fertilizer plus magnesium, zinc, copper, and boron. In January, 1952, none of those receiving magnesium showed any trace of blueing while the controls showed over 90 per cent. Dolomite or magnesium sulphate distributed over the plantation reduced incidence from 25 to 30 per cent. in the dry season of 1950–1 to about 1 per cent. in 1951–2. The magnesium may be acting alone, its absence inducing the disorder, or there may be a magnesium-potassium equilibrium which is disrupted by heavy potash applications. Dolomite at 1 kg. per plant, magnesium sulphate at 100 gm. (to be omitted in dry weather to avoid burning), a mixture of nitrate, lime, and magnesium, or magnesium ammonium phosphates are recommended locally.

Venkatakrishniah (N. S.). **Glomerella psidii (Del.) Sheld. and Pestalotia psidii Pat. associated with a cankerous disease of Guava.**—*Proc. Indian Acad. Sci.*, Sect. B, **36**, 3, pp. 129–134, 1 pl., 1952. [Received 1953.]

A canker or scab of guava fruits is serious in Mysore on both local and grafted varieties. Two fungi were isolated from infected fruits, *Glomerella psidii* [*R.A.M.*, 32, p. 176] (of which the perfect state occurred only in culture), and *Pestalotia psidii* [31, p. 390]. Both species were often present in cankers on young green and mature fruits and in leaf spots, but could not be isolated from small circular spots on the buds and calyx. Infected fruits became hard, malformed, and dropped off. In inoculation experiments on leaves and fruit the Banaras and Bangalore varieties were readily infected, while Allahabad, Safeda, and seedless varieties were not. *G. psidii* infected apple, chilli, *Citrus aurantiifolia*, mango, papaw, banana, and tomato, while *P. psidii* had no effect on these fruits. The spread of these fungi in the early stages of infection is controlled by three or four sprayings with 1 per cent. Bordeaux mixture or lime-sulphur (1 in 25) at 15-day intervals.

Zentmyer (G. A.). **Avocado diseases. Four maladies are being studied by scientists at Experiment Station.**—*Citrus Leaves*, **31**, 11, pp. 10–11, 1951. [Abs. in *Fruits d'outre mer*, **7**, 7, *Suppl.*, **9**, 7, p. 219, 1952.]

Notes are given on work in progress at [California Citrus] Experiment Station for the control of avocado root rot (*Phytophthora cinnamomi*) [*R.A.M.*, 33, p. 99] and fruit rot (*Dothiorella* sp.) [*Botryosphaeria ribis*: 31, p. 132]. Black streak, due to infection by *B. ribis* and to a high sodium content of the leaves, is confined chiefly to Guatemalan varieties. Studies are also being made on the symptoms, hosts, and inoculation techniques for the virus causing sun blotch [20, p. 484].

Kirby (A. H. M.) & Frick (E. L.). **Modifications in the glass-slide spore-germination test for use in fungicide research.**—*Rep. E. Malling Res. Sta., 1952*, pp. 161–167, 1 diag., 1953.

The following modifications of Montgomery and Moore's slide germination technique [*R.A.M.*, 17, p. 405] are intended particularly for use with *Venturia inaequalis* [33, p. 92] and *V. pirina*. The surface area for the spore deposit on the slide is delimited by a circular groove with sharp edges cut with a diamond-impregnated drill and then planed smooth. Of 12 surfactants compared with a

standard sulphite lye solution for wetting [cf. 33, p. 164], re-wetting, and inhibiting spore germination, triton X 100, triton X 155, and lissapol NXA were the most satisfactory. A final concentration of 0·0125 per cent. triton X 100 is being used successfully at present. Conidial cultures from single ascospores were made weekly on autoclaved 2-in. pieces of one- or two-year peeled apple wood; after ten days at 18° to 20° C. the spores were shaken free, the suspension being centrifuged three times for 30 seconds at about 2,400 r.p.m. At lower speeds the spores tended to float. The final suspension germinated almost completely after six hours in a nutrient medium containing 0·1 per cent. sucrose and 0·001 per cent. trisodium citrate, as against up to 42 hours in the presence of cupric ions. Counting was facilitated by using a Vickers Projection Microscope.

COURSHEE (R. J.). **Developments in drift spraying.**—*World Crops*, 5, 3, p. 109, 1953. [Abs. in *Emp. Cott. Gr. Rev.*, 30, 3, p. 228, 1953.]

The author discusses the use of ground sprayers for drift spraying, i.e., at right angles to the wind, the droplets falling slowly as they drift down wind [cf. *R.A.M.*, 27, p. 328; 29, p. 573].

HOARE (E. R.). **The world spraying problem.**—*Fm Mechaniz.*, 4, pp. 181–183, 240–243, 281–284, 1952. [Abs. in *Emp. Cott. Gr. Rev.*, 30, 3, p. 228, 1953.]

These three papers deal with the engineering aspects of chemical spraying against plant pests and diseases, with particular reference to plantation crops.

KAY (K.) & BALL (W. L.). **A practical approach to the toxicological evaluation of insecticides and fungicides.**—Abs. in *Proc. Canad. phytopath. Soc.*, 20, p. 18, 1953.

The Department of National Health and Welfare, Ontario, in co-operation with the Science Service of the Department of Agriculture, is investigating the effects of different pesticides on the workers handling them [*R.A.M.*, 32, p. 328]. The health hazard from pesticides depends not only on the toxicity of their active ingredients but also on the effect of the specific formulation and the manner in which the pesticides are applied.

LARGE (E. C.). **Some recent developments in fungus disease survey work in England and Wales.**—*Ann. appl. Biol.*, 40, 3, pp. 594–599, 1953.

In this paper, read before the Association of Applied Biologists in London on 27th February, 1953, the author presents a progress report on fungus disease survey work in England and Wales (with over 370,000 farms and 14,000,000 acres of arable land under crops or rotation grasses) by the Ministry of Agriculture's Plant Pathology Laboratory, Harpenden, Herts. [*R.A.M.*, 29, p. 222]. The ultimate aim is to obtain a true estimate (extent and severity) of the significance to the farmer and to the national economy of each of the chief plant diseases affecting the crops over the whole area.

As examples of the work recently done (in association with the Conference of Advisory Plant Pathologists in the National Agricultural Advisory Service) the author briefly reviews and discusses investigations undertaken on the forecasting and assessment of potato blight [*Phytophthora infestans*] (in collaboration with the Agricultural Branch of the Meteorological Office) [32, p. 585], trials with substitutes for sulphuric acid for destroying potato haulms [32, p. 395], surveys for choke (*Epichloe typhina*) on cocksfoot [*Dactylis glomerata*: 32, p. 384], work during the past year only on estimating damage caused by potato scab [*Actinomyces scabies*], which has already demonstrated marked regional differences in incidence as well as marked differences in varietal susceptibility, and an attempt to determine the

real extent of the damage caused by clover rot [*Sclerotinia trifoliorum*: 31, p. 241] and to distinguish that damage from the effects of other disorders. The author suggests the name 'plant pathometry' for disease measurement or assessment.

Koch (L.). **Combined plant introduction for Western Europe?**—*Euphytica*, 2, 3, pp. 207–210, 1953. [Dutch summary.]

The author proposes that Western European countries with similar climatic conditions should co-operate in the establishment of an efficient plant introduction service whereby groups of specialists should be stationed permanently in the countries being explored. Plants selected in those countries should be cultivated first in 'strain stations' there and quarantined before being sent on to local strain stations in Europe for further quarantine and eventual propagation by local breeders. These stations should be concerned solely with preliminary testing and keeping the material alive. He recommends testing any strain that becomes available, even though it may not seem suited to a cooler climate, in view of the unlikely origins of some of the most common European crop plants.

Aoshima (K.). **Sexuality of Elfvingia applanata (Fomes applanatus).**—*Nagaoa* (*Mycol. J. Nagao Inst.*), *1953*, 3, pp. 5–11, 1 pl., 7 figs., 1953.

Investigations in the Laboratory of Forest Pathology and Mycology, Government Forest Experiment Station, Meguro, Tokyo, have demonstrated that single-spore mycelia of *Fomes applanatus* [*Ganoderma applanatum*] have no clamp-connexions and that the fungus is heterothallic and tetrapolar.

Gordon (W. L.). **Sexual phenomena related to the production of perithecia in certain species of Fusarium.**—Abs. in *Proc. Canad. phytopath. Soc.*, 20, p. 15, 1953.

The following have been induced to form fertile perithecia at the Dominion Laboratory of Plant Pathology, Winnipeg: *Gibberella fujikuroi*, *G. cyanogena* (both are bisexual, intra-sterile, and inter-fertile), *G. zeae*, *Calonectria rigidiuscula*, *C. nivalis*, and one isolate of *Hypomyces solani* (all bisexual and self-fertile).

Weiss (F.) & Oteifa (B. A.). **Preservation of cultures of microorganisms under oil seal.**—Abs. in *Phytopathology*, 43, 7, p. 407, 1953.

During the last four years, agar cultures of fungi, actinomycetes, and bacteria at the American Type Culture Collection have been maintained under paraffin oil [cf. above, p. 230]. Some 96 per cent. of the 1,224 strains so treated in 1951 were recovered after 12 to 18 months, while individual examples of three to five years' survival are recorded.

Haskins (R. H.) & Anastasiou (Joan). **Comparisons of the survivals of Aspergillus niger spores lyophilized by various methods.**—*Mycologia*, 45, 4, pp. 523–532, 1 fig., 1953.

In work at the Prairie Regional Laboratory, Saskatoon, Canada, three methods of preserving fungal spores in the lyophil state [*R.A.M.*, 32, p. 494] were compared, using *Aspergillus niger*. The first involved snap-freezing to low temperatures, the second was essentially Ledingham's method [26, p. 408], while the third was a centrifugal freeze-drying technique in which the tubes containing the unfrozen spore suspensions were angle-centrifuged during the initial stages of evacuation to prevent boiling, until evaporative (auto-) freezing had occurred. After the first drying the tubes were given a second drying and then evacuated again.

Percentage spore germination following the third method was significantly higher than with the other two. This resulted from preliminary evaporation in the

liquid state followed by final sublimation from the frozen state, and did not appear to be due to more efficient wetting of the spore surface, but to a degassing effect. Of the limited series of suspending media tested by the centrifuge method, 20 per cent. glucose or sucrose gave the highest survival rate (over 80 per cent.). The use of such vehicles and of the centrifuge method of spore preservation does not induce the formation of loose, dried pellets, readily removable from the tube when the culture is to be revived, but the increase in survival may more than offset this disadvantage.

Dulaney (E. L.). **Observations on Streptomyces griseus. VI. Further studies on strain selection for improved streptomycin production.**—*Mycologia*, 45, 4, pp. 481–487, 1953.

Continuing his studies on *Streptomyces griseus* [*R.A.M.*, 28, p. 636], the author, using ultra-violet light, X-rays, and natural selection, obtained mutants capable of producing more than eight times the streptomycin broth potency of the initial culture.

Ehrlich (J.), Anderson (Lucia E.), Coffey (G. L.), Hillegas (A. B.), Knudsen (Mildred P.), Koepsell (H. J.), Kohberger (Dorothy L.), & Oyaas (J. E.). **Antibiotic studies of azaserine.**—*Nature, Lond.*, 173, 4393, p. 72, 1953.

In studies at the Research Laboratories of Parke, Davis & Co., Detroit, Michigan, crystalline azaserine obtained from *Streptomyces* (Parke-Davis No. 04926) inhibited species of *Alternaria*, *Armillaria*, *Aspergillus*, *Cercospora*, *Gelasinospora*, *Helminthosporium*, *Nematospora*, *Polysporus*, and *Poria* at 250 μgm. per ml. or less but was only moderately active against bacteria.

Hesseltine (C. W.). **Study of trickling filter fungi.**—*Bull. Torrey bot. Cl.*, 80, 6, pp. 507–514, 6 figs., 1953.

Samples of the substratum from three different positions in the trickling filter beds at the Lederle sewage disposal plant, Pearl River, New York, have been studied each month since late in 1950. The considerable amount of fungus mycelium present, which was assumed to contribute to the economy of the oxidation process and to constitute a regular portion of the flora of the beds, fell into three distinct species. One, *Fusarium episphaeria* (previously reported as *F. aquaeductum* [*R.A.M.*, 12, p. 58]), was so abundant at times on the rocks at the surface of the filter system that the beds assumed a dull reddish colour, particularly at the edges. It appears to be strictly aerobic and is somewhat reduced during the winter. The second fungus, *Geotrichum candidum* (*Oospora lactis*) [cf. 25, p. 309], appearing as greyish, mucus-like masses, was more abundant in the cooler months. The third species differed from the others in that it grew abundantly underneath the stones instead of on the surface and was also obtained deep down in the beds where there was less oxygen. It appeared as blackish mycelial masses incorporating large quantities of inert material.

A new genus, *Subbaromyces*, is proposed for this fungus. It is characterized by partially submerged, later superficial, membranous, syringe-shaped perithecia with a long beak, divided by a large collar into a lower cylindrical portion and an upper part tapering to a small ostiole surrounded by a fringe of hyphae; the clavate, eight-spored, non-paraphysate asci are soon autodigested; the hyaline, equally bicellular ascospores, surrounded by a gelatinous envelope, are extruded from the ostiole as a mucus-like droplet; the unicellular conidia are formed exogenously in succession.

In *S. splendens* n.sp. the membranous, dark-coloured, smooth-walled perithecia (in mixed culture on agar) are 1 to 2 mm. long at maturity; the bulbous base is 165 to 275 μ in diameter; the beak is 66 to 126 μ in diameter below the collar and

tapers from 44 to 60 to 16 to 27 μ above; the collar is 139 to 192 μ in diameter; the length above is 330 to 575 μ. The ostiolar hairs are pale, 40 μ long, and have acute tips. The clavate, stipitate asci measure 36 to 62 by 12 to 27 μ and the smooth, ellipsoid, irregularly arranged ascospores are 18 to 24 by 5 to 9·5 μ and surrounded by a gelatinous envelope up to 6 μ thick. The hyaline, granular, ellipsoid conidia measure 31 to 52 by 11 to 15 μ and are slightly flattened at the point of attachment.

WEGENER (W.) & QUESTEL (R.). **Mikrobielle Schädigung an Leinengarnen und -geweben.** [Microbial damage to linen yarns and fabrics.]—*Melliand Textilber.*, 34, 1, pp. 12–16; 2, pp. 100–102; 3, pp. 171–178, 3 figs., 6 graphs, 1953. [French, English, and Spanish summaries.]

This is a comprehensive, fully tabulated report of studies covering a period of 18 months on the fungal and bacterial damage to linen yarns and fabrics in Germany [cf. *R.A.M.*, 31, p. 506 and next abstract].

A list is given of the species isolated on malt agar. The periodical shake-off results are demonstrated by plotted frequency curves, which revealed a regular rhythm of 38 to 54 days for the maximum and minimum values of the *Penicillium* spp., while other fungi imperfecti, including *Aspergillus* spp., pursued independent courses, the latter tending to increase with the decline of *P.* spp. and bacteria.

Photomicrographs are given of degenerate forms of various species and microbial damage to linen and cotton. Noteworthy are the interrelationships between the pH and the time-dependent breaking duration, elongation at breaking, and tensile strength. The curve representing time and tensile strength virtually reflects that for time and pH.

WEGENER (W.) & QUESTEL (R.). **Mikrobielle Schädigung an Grege.** [Microbial damage to raw silk.]—*Melliand Textilber.*, 34, 5, pp. 403–404; 6, pp. 494–499, 2 figs., 2 graphs, 1953. [English, French, and Spanish summaries.]

In this further study on microbial damage to textiles in Germany [cf. preceding abstract] raw silk was exposed for three years in a dark cellar at a relative atmospheric humidity of 70 to 90 per cent. and a temperature of 5° to 15° C. The material was then sorted into four grades of tendering and maintained for a further 18 months at a relative humidity of 92 per cent. and a temperature of 25°. A list is given of the fungi revealed by periodical examinations, chiefly species of *Aspergillus* and *Penicillium*.

In shake-off cultures numbers of *Penicillium* spp. reached their peak in regular rhythms of 35 days, and *Aspergillus* spp. in 39 days, their maximum incidence coinciding with the minimum of bacteria and vice versa.

One series of 21 photomicrographs portrays the agar forms of the fungi on the sericin constituent of the silk and the other the 'degenerate' forms attacking the fibroin.

PENNING (H.). **Mould on butter.**—*Fmg in S. Afr.*, 28, 331, pp. 330, 339, 1953.

Mould [unspecified] on butter [*R.A.M.*, 30, p. 531] causes considerable annual losses to the South African dairy industry. It should be reduced by avoiding laying the butter on a wet surface, eliminating ceiling contamination during manufacture caused by condensation of steam or insufficient ventilation, the use of fresh, dry wrappers disinfected by exposure to the vapour from a mixture of formalin and potassium permanganate for at least six hours, and storing at a temperature well below 15° F. During recent years mould incidence has decreased markedly in creameries employing a mechanical wrapping apparatus.

HARLEY (J. L.), BRIERLEY (J. K.), & MCCREADY (C. C.). **The uptake of phosphate by excised mycorrhizal roots of the Beech. V. The examination of possible**

sources of misinterpretation of the quantities of phosphorus passing into the host.—*New Phytol.*, 53, 1, pp. 92–98, 2 graphs, 1954.

Part IV of this series of experiments conducted in the Department of Botany, University of Oxford [cf. *R.A.M.*, 32, p. 142] (*New Phytol.*, 52, p. 124, 1953) was concerned with the effect of oxygen concentrations on the absorption of phosphate by the fungal sheath and host core in excised, mycorrhizal beech roots. In the present series the authors examined the method employed for estimating P^{32} absorption and concluded that it is unlikely to lead to an underestimation of the total phosphorus passing into the host.

Hotson (H. H.). **The growth of rust in tissue culture.**—*Phytopathology*, 43, 7, pp. 360–363, 2 figs., 1953.

Most of this information on the growth of gall tissue of *Gymnosporangium juniperi-virginianae* on cultured tissue of *Juniperus virginiana* has been noticed from other sources [*R.A.M.*, 30, p. 594: 32, p. 273]. At the time of writing the tissues had been in continuous subculture for four years without sporulation.

Kalyanasundarum (R.). **Ascorbic acid and Fusarium wilted plants.**—*Proc. Indian Acad. Sci.*, Sect. B, 36, 3, pp. 102–104, 1952. [Received 1953.]

In studies at the University Botany Laboratory, Madras, it was found that *Fusarium vasinfectum* on cotton [*R.A.M.*, 32, p. 624] and *F. udum* on red gram (*Cajanus cajan*) [32, p. 23] bring about a striking reduction in the ascorbic acid content of the leaves of the host and an increase in the reducing sugar content. It is concluded that the reduction of the chlorophyll and retardation of growth which precede wilting cause the decrease in ascorbic acid content.

Miller (J. J.), Webb (N. P.), & Reid (J.). **Some experiments on the stimulation of sporulation in Trichoderma lignorum by radiation.**—Abs. in *Proc. Canad. phytopath. Soc.*, 20, pp. 19–20, 1953.

The effect of light on conidial formation in an isolate of *Trichoderma lignorum* [*T. viride*: cf. *R.A.M.*, 32, p. 206] was studied in the Department of Botany, McMaster University, Hamilton, Ontario. Only a few conidia developed in the dark, but exposure of 1 minute to 1 candle-power sufficed to induce intense sporulation in cultures. The violet and blue wavebands were the most strongly stimulating; yellow and red light and X-rays had no effect.

Wolf (F. T.). **The utilization of carbon and nitrogen compounds by Ustilago zeae.**—*Mycologia*, 45, 4, pp. 516–522, 1953.

In work at Vanderbilt University, Nashville, Tennessee, on the growth of *Ustilago zeae* [*U. maydis*: cf. *R.A.M.*, 13, p. 460; 17, p. 618; 30, p. 226; 31, p. 448] in synthetic media, four monospore cultures derived from a single promycelium were studied. Glucose, laevulose, mannose, sucrose, maltose, and trehalose were the best of 20 carbon sources tested. *U. zeae* was able to utilize nitrate, ammonium, and amino nitrogen. Good growth resulted in 19 of 23 amino acids tested as sole sources of nitrogen, aspartic acid, asparagine, and serine giving the best results. No qualitative differences in utilization of any of these substances were shown by the strains.

Hogen Esch (J. A.). **Fifteen years' activity of the Commission for the Advancement of Potato Breeding.**—*Euphytica*, 2, 3, pp. 211–223, 8 figs., 1 diag., 1 map, 1953. [Dutch summary.]

The author describes the work accomplished since its inception in 1938 by the Commission for the Advancement of Potato Breeding in Holland [cf. *R.A.M.*,

31, p. 476] from the aspects of technical assistance to breeders, the testing of seedlings for resistance to specified diseases, and new varieties added to the annual Descriptive Lists.

BAGNALL (R. H.). **Potato seedlings hypersensitive towards Solanum virus I, Smith (Potato virus X), and a rapid means of detecting the reaction.**—Abs. in *Proc. Canad. phytopath. Soc.*, 20, p. 14, 1953.

In further work by the Canadian Department of Agriculture, Fredericton, New Brunswick, the breeding of seedlings possessing either immunity from or the hypersensitive form of resistance to potato virus X [*R.A.M.*, 32, p. 666] was commenced in 1950. The immune parent was U.S.D.A. Seedling 41956 and the hypersensitive parents the British variety Epicure and certain Scottish seedlings. These were crossed with pollen from American seedlings resistant to late blight [*Phytophthora infestans*]. Inoculation with virus X of cuttings grown in vermiculite proved to be a successful means of detecting reaction, the plants from which the cuttings were taken forming new shoots and later tubers.

KHANNA (M. L.) & GANGULY (B.). **Loss in yield in Craigs Defiance Potato variety due to virus 'Y'.**—*Sci. & Cult.*, 19, 5, pp. 257–259, 1953.

Studies were carried out at the Potato Breeding Substation, Simla, India, to investigate the influence of time of disease appearance on the loss in tuber yield caused by potato virus Y [*R.A.M.*, 32, p. 275] in the commercial variety Craigs Defiance [28, p. 306], which is field immune from potato viruses A [loc. cit.], C [? strain of potato virus Y], X [30, p. 510], and B [strain of potato virus X], but highly susceptible to virus Y. In preliminary glasshouse experiments in 1951 one set of disease-free plants was inoculated with virus Y in July, one month after germination, and another in August, by grafting infected tobacco scions. All the inoculated plants showed severe symptoms of virus Y, the average weight of tubers per plant being 11·62 gm. for the first set and 18·75 gm. for the second, compared with 83·5 gm. for the uninoculated controls, giving yield losses of 86 and 77·5 per cent., respectively, for the two sets.

In similar experiments conducted in 1952 the average weight of tubers per plant in the first set (inoculated at one-month old in the last week of May) was 10·3 gm. and in the second (inoculated at two months during the last week of June) 11·34 gm., compared with 83 gm. for the control, corresponding to yield reductions of 87·5 and 86·3 per cent., respectively.

The average yields per plant in field experiments in 1952 from healthy tubers and those infected with virus Y the previous year were 12·47 and 2·07 oz., respectively. It is, therefore, essential to use seed free from virus Y infection for commercial crops of this variety.

HUTTON (E. M.) & BROCK (R. D.). **Reactions and field resistance of some Potato varieties and hybrids to the leaf-roll virus.**—*Aust. J. agric. Res.*, 4, 3, pp. 256–263, 1953.

In studies conducted at the Division of Plant Industry, Canberra, from 1949 to 1952, the leaf roll reactions of a number of potato hybrids and varieties [*R.A.M.*, 32, p. 235] were defined over a two year period by external symptoms and the amount of phloem necrosis present in stem sections [cf. 33, p. 171]. Five to ten tubers were retained from each of 58 hybrids sprout-inoculated with *Myzus persicae*; in the next season in 38 per cent. all the plants from the original sample gave the same reaction to leaf roll, while in the remainder the proportion of plants of each set giving the same reaction varied from 40 to 90 per cent. In some instances one plant had no symptoms, though the others showed severe infection; this was

usual with resistant hybrids. A close correlation was established between the severity of external leaf roll symptoms and the extent of stem phloem necrosis as detected by the phloroglucinol test [31, p. 624]. High and significant percentages of the tubers, from which the shoots failed to emerge or died soon after emergence, had stem-end necrosis and spindly sprouts. Plants with very severe symptoms were grown from significantly greater percentages of tubers with stem-end necrosis than the plants of the other symptom classes.

The hybrid 95–79 had high field resistance in 1950–1, but little in 1951–2. Bismark displayed outstanding resistance and was able to carry the virus without symptoms, the disease being transmitted to a small proportion of the progeny. The resistance of Bismark and some hybrids appears to depend on a virus-inactivating mechanism which is continually localizing the virus and reducing its concentration, with the result that even plants with severe symptoms produce varying percentages of progeny free from symptoms.

The initial selection of resistant hybrids could be made by sprout-inoculation, those with a proportion of the tuber progeny free from leaf roll being kept. Bismark could be used as a parent for leaf-roll resistance.

Howard (H. W.). **Physiological races of Phytophthora infestans : a comparison of the differential hosts at the Plant Breeding Institute, Cambridge, with those of the Scottish Society for Research in Plant Breeding.**—*Ann. appl. Biol.*, 40, 3, pp. 584–593, 1953.

In a comparison of the reactions of the differential potato varieties used for distinguishing the physiologic races of *Phytophthora infestans* [see following abstracts], those used at the Plant Breeding Institute, University of Cambridge, were inoculated with Black's races B^1, B^2, *C*, and *D*; the standard races, *A*, *B*, and *C* used at Cambridge were tested on the four differential hosts used by Black; and other isolates from England and Northern Ireland were tested on both sets of hosts. The work was done entirely with detached leaflets sprayed with a spore suspension.

The results demonstrated that the Cambridge differential hosts 104/14, carrying the genes *AbC*, and 72/105, carrying *ABc* (where *A* = resistant to race *A*, *a* = susceptible, etc.), carry, according to the Scottish scheme, Ab^1b^2CD and AB^1B^2cD, respectively, and that the Cambridge races *A*, *B*, and *C* correspond to the Scottish races *A*, B^1, and *C*, respectively.

Isolations of *P. infestans* from potato plants over many years showed that race *A* was obtained from standard commercial varieties, while blight-resistant seedlings yielded B^1, B^2, *C*, and *D*.

Black (W.), Mastenbroek (C.), Mills (W. R.), & Peterson (L. C.). **A proposal for an international nomenclature of races of Phytophthora infestans and of genes controlling immunity in Solanum demissum derivatives.**—*Euphytica*, 2, 3, pp. 173–179, 4 diags., 1953. [Dutch summary.]

In co-operative studies between the Scottish Plant Breeding Station, Edinburgh, the Plant Breeding Station Centraal Bureau, Hoofddoorp, Holland, and Pennsylvania State College the authors exchanged their series of differential potato plants for testing the races of *Phytophthora infestans* at their disposal.

In the Scottish experiments the hosts were inoculated with eleven races of *P. infestans*, of which A, B^1, B^2, C, and D were of Scottish origin [*R.A.M.*, 33, p. 47 and preceding abstract]; E was obtained from Tanganyika [32, p. 11]; F was isolated with and presumably arose from E; G and H came from Kenya [see above, p. 215]; and I and J from Peru [31, p. 626; 32, p. 501]. The Netherlands experiments were conducted with races N1 to N9 (excluding N3) [32, p. 206], and those in Pennsylvania with the United States races A, B, C, D, BC, and BD [32, pp. 208,

368], which have been isolated repeatedly from field plots in New York and Pennsylvania.

The results demonstrated the existence of 13 distinct races of *P. infestans*, six of them common to all three collections. Apart from these and three hypothetical ones, others, against which the known genes are ineffective, may arise. As the result of these studies it is now possible to compare the various genes, four of which are involved, and to adopt a standard nomenclature for international use, so that race 0 will include A, N1, and A (of Black, Mastenbroek, and Mills and Peterson, respectively); 1 (B^1, N2, D); 2 (H, N5, C); 3 (J); 4 (D, N4, B); 1,2 (G); 1,3 (E); 1,4 (B^2, N7, BD); 2,4 (C, N6, BC); 3,4 (I); 1,2,4 (N8); 1,3,4 (F); and 2,3,4, (N9). The authors propose that Black's system of nomenclature be adopted (*Proc. roy. Soc. Edinb.*, 65, pp. 36–51, 1952) and the resistance genes involved be designated R_1, R_2, R_3 and R_4 [33, p. 47 and next abstract].

Mastenbroek (C.). **Experiments on the inheritance of blight immunity in Potatoes derived from Solanum demissum Lindl.**—*Euphytica*, 2, 3, pp. 197–206, 1 fig., 1953. [Dutch summary.]

At the Plant Breeding Station of the Centraal Bureau, Hoofddoorp, Holland, progenies of crosses of the genetical types (dominant symbols only) $R_1 \times R_3$, $R_1R_3 \times r$, $R_1R_3 \times R_3$, $R_1R_3 \times R_1$, $R_3 \times R_1R_2$, $R_3 \times R_1R_3$, $r \times R_1R_3$, $R_1R_3 \times R_1R_2$, $R_1R_3 \times R_1R_3$, and R_1R_3 S.P. (spontaneously pollinated) were inoculated with and selected for immunity from races 1,2,4 and 2,3,4 of *Phytophthora infestans* [see preceding abstract] during 1951 and 1952. One $R_3 \times R_1R_3$ progeny, two from $R_1R_3 \times R_1R_3$, and six out of ten S.P. progenies segregated with a larger or smaller deficit of immune seedlings than was expected from the hypotheses postulated for the reactions of the genes involved and which appeared to be in agreement with the observed segregations in the other progenies.

Beaumont (A.), Bant (J. H.), & Storey (I. F.). **Potato spraying trials in Yorkshire, 1947–51.**—*Plant Path.*, 2, 2, pp. 56–60, 5 graphs, 1953.

From an investigation into the economy of spraying potatoes against blight (*Phytophthora infestans*) [see above, p. 244] in South Yorkshire from 1947 to 1951 the authors conclude that even if commercial spraying were as well-timed and effective as the careful spraying carried out on the trial plots, and no loss resulted from damage by the sprayer wheels or by copper injury to foliage following insect attack in dry seasons, the total gain from increase of crop would have been only just sufficient to cover the cost. Protective spraying against potato blight is considered to be hardly justified as a routine measure on Yorkshire farms.

Malmus (N.). **Die Kraut- und Knollenfäule der Kartoffel. Forderungsmassnahmen zu ihrer Bekämpfung in Bayern.** [Potato shoot and tuber blight. Measures for the furtherance of its control in Bavaria.]—*Pflanzenschutz*, 4, 12, pp. 144–146, 1952.

This information on the increased potato yields obtained by spraying against blight (*Phytophthora infestans*) in Bavaria has been noticed, in part, from another source [see above, p. 206].

Hollis (J. P.). **An approach to the physiology of toxin formation in microorganisms.**—*Phytopathology*, 43, 7, pp. 355–359, 2 diags., 1953.

In this paper, presented at the Symposium on Physiology of Parasitism at the 44th Annual Meeting of the American Phytopathological Society at Ithaca, New York, on 9th September, 1952, further studies are described from the Department of Botany, University of Missouri, Columbia, on the possibility of an indirect

relationship, in terms of stimulatory compounds, between a tyrosine-melanin shunt and metabolic toxigenic systems in a pathogenic isolate of *Streptomyces* [*Actinomyces*] *scabies* from potato [*R.A.M.*, 32, p. 33], an isolate of the same fungus that had lost its virulence, and a saprophytic *S.* species from the surface of a scab lesion.

Melanin production and growth in the pathogenic strain of *A. scabies* in a synthetic medium containing 0·1 per cent. tyrosine were stimulated by the L-isomers of arginine, lysine, histidine, phenylalanine, alanine, and aspartic and glutamic acids, and inhibited by cystine and glycine. In general, the responses of the other two isolates to the stimulatory amino acids were comparable to the foregoing and therefore the mechanism responsible for parasitism must reside in some other system.

Roux (E. R.). **A preliminary account of 'glassy end' in Potatoes.**—*Fmg in S. Afr.*, 28, 331, pp. 341–344, 1 fig., 2 graphs, 1953.

A condition known as 'wateriness' of potatoes, apparently identical with 'glassy end' [*R.A.M.*, 33, p. 176], occurs frequently in South Africa, where it is commonly attributed to the practice of leaving the tubers in the soil after they have ripened and the tops have died. Experiments conducted during 1952–3 confirmed that the glassy, starch-free area always occurs at the stem end, though it may extend some way into the rest of the tuber. The disorder is evidently due to conditions during growth; it did not change appreciably in degree when the tubers were left in the soil or removed and stored under wet or dry conditions for some months or until they began to sprout. Penman's suggestion regarding carbohydrate translocation from the tubers following a drought during the growing period [9, p. 126] has yet to be substantiated.

Hewitt (E. J.) & Bolle-Jones (E. W.). **Studies in iron deficiency of crops. II. The interrelationships of iron and potassium in the Potato plant.**—*J. hort. Sci.*, 28, 3, pp. 185–195, 1 pl., 1953.

In further sand-culture studies at Long Ashton Research Station, University of Bristol [*R.A.M.*, 26, p. 418], iron deficiency symptoms in Majestic potato plants were accentuated by potassium deficiency, while increased potassium decreased apical chlorosis and produced vigorous, pale green plants. At the lowest potassium level plants in all iron treatments showed symptoms of severe potassium deficiency. Increased iron delayed but ultimately increased the severity of the potassium deficiency symptoms. Phosphorus deficiency was accentuated by increased iron or potassium. Increased iron usually decreased the 'soluble' and total potassium in young leaves and increased the old to young leaf ratios for 'soluble' and total potassium. Extra potassium mostly increased the iron content at the higher iron levels; at the lowest iron level it decreased it in young and increased it in old leaves. Total phosphorus content declined with increased potassium or iron, while calcium content decreased with increased iron. Extra potassium increased then decreased calcium in the leaves. These results support the view that iron and potassium are interrelated in the metabolism of the potato plant. Potassium may facilitate the utilization of iron, and iron may impede the translocation of potassium.

Akai (S.) & Ueyama (A.). **The catalase activities in the leaves of Rice plants and the occurrence of Helminthosporium blight. A preliminary report.**—*Igaku to Seibut.* (*Med. & Biol.*), 26, pp. 70–72, 1953. [Abs. in *Chem. Abstr.*, 47, 21, p. 11363, 1953.]

In studies at Kyoto University, Japan, the catalase activity of leaf homogenates of rice plants increased 24 hours after inoculation with the agent of *Helminthosporium* blight [*Ophiobolus miyabeanus*: *R.A.M.*, 33, p. 113] to about 150 per cent.

of the original value, decreased to the initial level after 40 to 50 hours, when small lesions developed on the leaves, and a further diminution gradually ensued. Spraying the foliage with mercuric chloride at 10^{-3} completely inhibited catalase activity and it was reduced to about 50 per cent. by copper sulphate at the same strength.

YOUNG (H. E.). **High Rubber yields on the hills—successful experiment by R.R.I.** —*Quart. Circ. Rubb. Res. Inst. Ceylon*, 28 (*1952*), 3–4, pp. 20–21, 1 pl., 1953.

The rubber clone LCB 870 [see following abstracts], resistant to *Oidium* [*heveae*: loc. cit.], has grown with great vigour and no loss of leaf since 1940 at the Kepitigalla estate in the Matale District (1,600 ft.) of Ceylon. Its growth compares favourably with that of the most vigorously growing low-country rubber. Each of the 24 trees planted in 1941 has yielded about 5 lb. per year, equivalent to approximately double the Ceylon average per acre. Although this is lower than the yield of some of the newer clones now being grown, these will not grow at high altitudes because of disease, whereas LCB 870 promises to yield well where other clones cannot survive.

YOUNG (H. E.). **Report of the Oidium Research Officer and Mycologist for the year 1951.**—*Rep. Rubb. Res. Bd Ceylon, 1951*, pp. 32–38, 1952.

In this report [cf. *R.A.M.*, 31, p. 205 and following abstracts] it is stated that during 1951 *Oidium heveae* was very severe in almost all the rubber-growing districts of Ceylon [loc. cit.; 31, p. 630, and preceding abstract], probably owing to the long dry period at the end of 1950, which forced many trees to defoliate prematurely. Refoliation was checked in November and December by normal wintering. This long refoliation allowed the disease to develop in sufficient quantities to provide heavy inoculum at normal refoliation time.

Trials were conducted with 'activated' Italian sulphur consisting of sulphur fused with carbon and ground to the required fineness. Rapid heat absorption by the carbon volatilizes the sulphur. The black cloud is visible during dusting operations and the area dusted is easily estimated. The control given by this product at 4 to 5 lb. per acre per round was equivalent to that given by 10 to 12 lb. ordinary dusting sulphur, but the price was more than double. Dusting before the epiphytotic begins is the key to control.

Clone LCB 870 [loc. cit.; 32, p. 147, and next abstract] again displayed much greater field resistance to *O. heveae* than any other clone. From cross-pollinations of LCB 870 with high yielding clones, 430 successful ones gave a good seed crop. Some 1,200 buddings of LCB 870 in the propagation nursery were disposed of to growers for crown budding purposes. In the crown budding trial of 250 pairs of twin seedlings [31, p. 630] those budded with LCB 870 had a higher girth increment in February than those budded with TJ 1.

It was thought that if artificial defoliation could be obtained by any means shortly before normal wintering, such defoliation would be an even one. This would remove infective material from the trees and allow new foliage to develop before infection became serious. Also, refoliation might occur earlier than usual in weather conditions less suitable for infection. Calcium cyanamide dust ('aero cyanamide') was accordingly applied with a Noidium duster [loc. cit. and next abstract] of a new type with a four-stroke engine, built according to the recommendations of the Rubber Research Institute. This machine gave an excellent performance. The cyanamide dust proved to be a very good source of nitrogen and was virtually the equivalent, weight for weight, of ammonium sulphate. The results of the experiment are not yet available.

Fomes lignosus [32, p. 211] is becoming more important as the old seedling rubber is replaced on most estates by budded rubber or clonal seedlings. *Hypocrella reineckiana* [31, p. 205] became more prevalent on [unspecified] scale insects

attacking rubber. Cases of secondary die-back due to *Botryodiplodia theobromae* [loc. cit. and next abstract] followed initial twig die-back induced by starvation following repeated attacks by *O. heveae*.

Van Emden (J. H.). **Report of the Mycologist for the year 1952.**—*Rep. Rubb. Res. Bd Ceylon, 1952*, pp. 53–63, 1953.

In this report [cf. preceding abstract] it is stated that as December, 1951, was very dry in Ceylon wintering of rubber trees began early and *Oidium* [*heveae*: loc. cit. and following abstracts] was present wherever young leaves formed. Infection continued to become more severe until April, when the south-west monsoon virtually ended further spread. Early-wintering clones were severely affected and late ones lightly. In August infection was again almost universally present in nurseries and on young shoots in the field, but no leaf fall occurred. Dry weather in July and August caused some clearings of BD 5 to begin wintering in September. These fields began to refoliate in October and benefited from the rain. Estates which started control practices directly the rains ceased obtained a healthy canopy even in fields which had been poor for some years. Alternating drought and rain clearly showed how the fields react almost immediately to rainfall, even a few inches postponing wintering. This is an important factor in the *O. heveae* problem. Most clones recovered well in May and June, probably because of abundant sun, but not in higher areas and in exposed fields, where some clearings remained almost leafless throughout the year. In such fields *Diplodia* die-back [*Botryodiplodia theobromae*: see preceding abstract] was severe, some trees dying back to below the tapping panel.

At the end of 1951 and during the first half of 1952 hardly any sulphur was obtainable. The only product available was a brown 'industrial sulphur' with a low sulphur content and a large coarse fraction. Used at a rate of 25 lb. per acre for six rounds it gave reasonable control of *O. heveae*.

Most growers disregarded the recommendations to dust in the absence of wind and when the leaves are moist with dew. The general practice was to start dusting after 9 a.m., when there was enough wind to carry the dust upwards and through the field, as most growers considered that it was impossible to blow the dust high enough and obtain the necessary depth of penetration with the existing machinery without the aid of wind. Experiments demonstrated, however, that both the Noidium (now universally used for sulphur dusting in Ceylon) and the Whirlwind dusters [see next abstract] blew the dust to a height of over 80 ft. in still air, even when moving at 2 m.p.h., the dust drifting laterally to about 100 ft. if the outlet was tilted to 30° from the vertical. A scarcely perceptible cross wind increased the lateral displacement to about 4 m.p.h. between 8 and 9 a.m., reduced the height obtained to about 30 ft., and blew the dust away horizontally so that it settled on the ground; if the wind occurred later, the dust was carried upwards, often reaching tree-top level at a distance of 200 to 300 ft. from the machine. It was, accordingly, recommended that (*a*) dusting should begin as early as possible in the morning; (*b*) it should stop as soon as wind velocity exceeded 2 to 4 m.p.h.; and (*c*) the machine should move along parallel lines about 100 ft. apart. In still air speed should not exceed 2 m.p.h.; in wind the machine should be moved with or across the wind only. If these instructions are followed the fields will be adequately dusted, provided the machine runs at 2,200 to 2,400 r.p.m. and the dust is of good quality.

Spraying experiments [with sulphur] were conducted with the low-volume 'micron sprayer' [*R.A.M.*, 31, p. 517] on individual late-wintering trees; the new leaves were adequately protected. On another estate a few strips of Pil B. 84 undergoing their third attack by *O. heveae* were also sprayed, with some effect. The output of the micron-sprayer should be well under 1 gal. per min.; with a larger output too many coarse droplets are formed which fail to reach the desired height.

Spraying from a helicopter is considered by the Rubber Research Institute to be too expensive.

In breeding for resistance to *O. heveae* 142 successful cross pollinations with LCB 870 [see preceding abstracts] gave 412 seeds of which 254 germinated. There were no immune seedlings.

In the author's view the considerable reduction in yield experienced in many TJ 1 clearings in 1951 and 1952 was at least partly due to brown bast [32, p. 148 and next abstract], which followed *O. heveae* attacks. As brown bast can become incurable if attention is not paid to it at once, fields with a marked decline in yield should be examined for this disease and tapping intensity reduced, if necessary. *Helminthosporium heveae* [19, p. 674; 32, p. 397] was present in all Rubber Research Institute nurseries and caused much leaf distortion. Dusting with cuprosana or spraying with perenox or lime-sulphur gave temporary protection.

In the section of this report dealing with chemistry (pp. 8–24) E. J. Risdon states that examination of samples from many estates showed that the volume of mouldy and stained laces and crepes during the second monsoon in Ceylon is not insignificant. Assessment of the mould suppressant ability of various chemicals is in progress, and the following is approximately their increasing order of efficiency: 1 per cent. dehydroacetic acid, 1 per cent. shirlan, 1 per cent. I.N. 2555, 0·1 per cent. paranitrophenol, 1 per cent. milban and 1 per cent. vulcastab DDM (equally efficient), and 1 per cent. nitrophenol.

Van Emden (J. H.). **Notes on sulphur dusting.**—*Quart. Circ. Rubb. Res. Inst. Ceylon*, 28 (*1952*), 3–4, pp. 12–15, 1953.

In dusting rubber in Ceylon against *Oidium* [*heveae*: see preceding and next abstracts] the rate of application for sulphur powders of different fineness and sulphur content should be calculated from the formula $\frac{85}{s} \times \frac{90}{f} \times$ recommended rate of application, where 's' represents the percentage of sulphur in and 'f' the percentage size of the fine fraction (passing a B.S. 300 sieve). The powder will flow freely if it does not form lumps or stick to the glass when about $\frac{1}{4}$ lb. is shaken in a dry glass jar, otherwise it should be dried in the sun. Sulphur dusts that do not flow freely cause the output of the machines to be irregular and do not rise well.

Both the Noidium and the Whirlwind dusters [see preceding abstracts] may be equipped with different power units, and the reliability of the engine and the weight of the duster may vary with the type of power unit.

Dusting should begin when 10 per cent. of the trees show green ends and continue until 90 per cent. have passed the sensitive stage. Where wintering is simultaneous and during fine weather the rate of application should be 12 lb. per acre per round of a dust containing a 90 per cent. fine fraction with a sulphur content of 85 per cent. If winter is prolonged it may be necessary to dust single trees or groups needing treatment, 5 lb. per acre twice a week being advisable. Areas severely affected in the past may require several months' dusting to protect the irregularly appearing new flushes. No hard and fast rules can be given.

The aim in dusting is to obtain a cloud which drifts laterally through the trees parallel to the land surface. Dusting after 8 a.m. [loc. cit.] should be under the strictest supervision and resorted to only in emergencies, though it is better to wait until the next morning. The machine must always be kept under the cloud of dust, or the dust will not go up high enough. In a light wind the machine should be moved for about 100 ft. with the feed closed, then put down for 10 seconds' dusting, and closed again for another 100 ft.

If resting the trees during wintering is omitted, brown bast [loc. cit.] increases and refoliation is retarded, with the result that exposure to infection by *O. heveae* is prolonged. Each clearing should be rested as soon as budbreak has begun in 20

per cent. of the trees. If the whole estate is rested simultaneously, some fields will be rested too early and others too late.

YOUNG (H. E.). **Oidium problem of Hevea.**—*Arch. Rubbercult. Ned.-Ind., 1953* (Extra number), pp. 127–131, 1953.

Most of the information in this paper (read at the Conference of Rubber Research Institutes in the Far East, held at Bogor, 15th to 17th July, 1952) on sulphur dusting against *Oidium* [*heveae*] on rubber in Ceylon and breeding for resistance has already been noticed from other sources [see preceding abstracts].

Annual Reports for 1949–51 of the Pathological Division of the Rubber Research Institute of Malaya.—50 pp., 1 fig.; 34 pp., 1 fig.; 34 pp., 1 fig., 1953.

Some of the information in these reports compiled by R. A. ALTSON [cf. *R.A.M.*, 30, p. 540] has been noticed from other sources [32, pp. 338, 397, 450, and below, p. 257.

The experiment to determine the influence of age and vitality of *Hevea* rubber trees on infection by *Ganoderma pseudoferreum* [32, p. 337], *Fomes noxius* [loc. cit.], and *F. lignosus* [see below, p. 257] has been completed. The results suggest that the intact roots of six-year-old trees were more susceptible to invasion by *F. lignosus* and *F. noxius* than were those of 20-year-old trees. The activity of *G. pseudoferreum* is not much affected by the age of the host. An experiment was initiated in 1949 to investigate the rate of loss of infectivity of these three root pathogens in diseased root fragments of various sizes buried at different depths in the soil. Loss of infectivity was most rapid in *F. noxius* and least in *G. pseudoferreum*. After two years' burial the difference in rate between *F. noxius* and *F. lignosus* was less evident, but *G. pseudoferreum* was still the most persistent.

These three root parasites differ in their tolerance of arsenic, *F. lignosus* requiring 2,500 to 3,000 p.p.m. for complete inhibition, *G. pseudoferreum* 1,125 to 1,250 p.p.m., and *F. noxius* only 200 to 300 p.p.m. It is considered that sodium arsenite is not sufficiently toxic to kill *F. lignosus* or *G. pseudoferreum* in old infected stumps [loc. cit.] or to prevent their growth, but its effect is to open the way for saprophytic fungi which prevent the parasites from becoming established. An experiment started in 1950 indicated that the most efficient method of stump poisoning is to introduce 15 oz. sodium arsenite in the form of a solution (10 lb. to 1 gal.) through 1 in. auger holes bored into the stump and downwards over the lateral roots.

The antagonism of *Trichoderma viride* to *F. lignosus* was confirmed by experimental work during 1951, but results for *Botryodiplodia theobromae* and *Ceratostomella* sp. were conflicting.

Mouldy rot of the tapping panel (*C.* [*Ceratocystis*] *fimbriata*) [see below, p. 258] continued to be troublesome throughout the period under review, though less so in 1951. This is thought to be due to increased use of wound dressings; the petroleum grease S[ocony] V[acuum] Product 2295-C [cf. 32, p. 508] yielded the best results, followed closely by a cow dung and clay mixture. Evidence has accumulated suggesting that P.B. 86 is more susceptible to black stripe (*Phytophthora palmivora*) [loc. cit.] than other clones grown in Malaya. Fissuring of the renewing bark is now regarded as a symptom of black stripe.

During the period there was a decrease of outbreaks of secondary leaf fall, mostly dueto *Oidium heveae* [see preceding abstracts] or a combined attack of *Gloeosporium albo-rubrum* [see below, p. 257] and the tea mite *Hemitarsonemus latus*.

There were fewer outbreaks of pink disease (*Corticium salmonicolor*) [30, p. 541], possibly because smallholders grow such a small proportion of young rubber. *In vitro* tests have shown that 0·28 per cent. fylomac 90 [see below, p. 258] is fungicidal to *C. salmonicolor*.

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